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REPORT OF HYDROGEOLOGIC INVESTIGATION AND GROUNDWATER EVALUATION ORTHO-CHEVRON CHEMICAL COMPANY PLANT MARYLAND HEIGHTS, MISSOURI

> WOODWARD-CLYDE CONSULTANTS 5055 Antioch Road Overland Park, Kansas

October 30, 1981

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WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS,
AND ENVIRONMENTAL SCIENTISTS

CONFIDENTIAL

October 30, 1981 S81-5

Mr. Donald F. Searle, Project Manager Environmental Control Chevron Chemical Company 575 Market Street San Francisco, California 94105

REPORT OF HYDROGEOLOGIC INVESTIGATION AND GROUNDWATER EVALUATION ORTHO-CHEVRON CHEMICAL COMPANY PLANT MARYLAND HEIGHTS, MISSOURI

Dear Don:

We are pleased to enclose this report of our hydrogeologic investigation and groundwater evaluation at the Ortho-Chevron Chemical Company plant in Maryland Heights, Missouri. This assessment of site conditions was performed in general accordance with our proposal to you dated January 16, 1981.

We have presented a discussion of our findings in this assessment including the concentration levels of constituents encountered in samples of soil and groundwater. We recommend additional analyses to confirm and extend these findings.

Please contact us with your comments regarding our investigation and this report.

Very truly yours,

D. Campbell, P. E.

Vice President

Donald M. Duncan, P. E.

Vice President

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#### **ACKNOWLEDGMENTS**

The preparation of this report and the field work reported herein are due largely to the efforts of the following Woodward-Clyde Consultants personnel: Mr. Philip Knotts (Project Engineer), Mr. William Prosser (Project Geologist), Mr. Peter Barrett (Staff Geologist), and Mr. Charles Huber (Laboratory Technician) with the support of Woodward-Clyde Consultants staff under the technical direction and supervision of Dr. J. D. Campbell (Project Manager). Technical advice and peer review for this project has been provided by Mr. Joseph Kolmer (Senior Project Engineer, Plymouth Meeting).

The authors wish to acknowledge the professional services of Wilson Laboratories, Salina, Kansas, and in particular Ms. Janis Butler (Laboratory Director), Mr. Robert Meyer (Chief Chemist), and Mr. Cliff Baker (Organic Chemist). Portions of their analytical reports have been incorporated by the authors in this report.

We acknowledge and appreciate the support and direction provided by Chevron Chemical Company's project management. Mr. R. Macauley initiated the project and provided Chevron's review of this report. Mr. Don Searle, the current Project Manager, has provided the recent coordination of this work. We appreciate the information and assistance provided by the Ortho-Chevron staff at the facility including Mr. Stan Kanes, Plant Manager, and Mr. Mike Coan and Mr. Dan Holman.

#### SUMMARY

Thirty-four soil borings were drilled during the field investigation conducted at the Ortho-Chevron Company Plant in Maryland Heights, Missouri. Borings were logged and soil samples were obtained at selected depths for engineering index testing and chemical analyses. The general subsurface profile consists of up to 8 feet of fill at the surface overlying 15 to 20 feet of stiff, brown, silty clay (loess). Underlying the loess is approximately 5 feet of highly plastic residual clay and beneath the clay is shale. The thickness of the shale is quite variable and in some places the shale is completely weathered to clay. Limestone was encountered beneath the shale and at depths ranging from approximately 30 to 70 feet.

Fifteen of the soil borings were completed as groundwater observation wells. Groundwater levels were monitored and groundwater samples were obtained for chemical analyses. The depth to groundwater varied from approximately 2 feet on the east side of the plant to approximately 10 feet on the west. The general direction of groundwater flow is to the west-northwest with an average gradient of approximately 0.021 foot per foot.

Two soil samples which appeared to be contaminated were analyzed for arsenic and organic pesticides. The analytical results presented in Tables 7, 9, and 10 indicate significant concentrations of arsenic and organic pesticides were detected in these soil samples. Near-surface soils which contain arsenic and organic pesticides may distribute these constituents to the environment through surface run-off, wind erosion or

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leaching into the groundwater. A <u>soil</u> survey has been <u>recommended</u> to identify those areas of the site where arsenic and pesticides are present and to measure the concentrations in the soil.

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Samples from the sediments and soil beneath the storm water retention pond and one composite soil sample obtained from the soil-debris waste pile were submitted to the laboratory for EP toxicity testing. The test results are presented in Table 11 and indicate that these materials do not exhibit the characteristics of a hazardous waste as defined by EP toxicity. These materials may still be classified as hazardous wastes if they are contaminated by an EPA listed hazardous waste and intended for disposal. Further review of these materials to establish a hazardous/non-hazardous classification has been recommended. Precautions should be taken when handling and disposing of these materials.

The analytical results for the groundwater samples obtained from fourteen wells are presented in Appendix F. The distribution of the various groundwater constituents as measured in each well around the site are presented in Figures 8 through 36. The test results indicate that the concentrations of chemical constituents in the groundwater entering the site from upgradient are relatively low and that the area with the highest measured pesticide concentrations is in the centrally located processing and handling area, in the vicinity of wells OWC-6, 7, 8, 10 and 11. The lack of continuity of measured concentrations between wells appears to indicate the presence of isolated individual contaminant sources. Table 12 presents the analytical results for the

organic constituents and selected inorganic constituents measured in each well and for comparison EPA drinking water standards and Missouri groundwater recharge standards.

The mass flow rate of groundwater through the area near OWC-6, 7, 8, 10 and 11 has been estimated at approximately 600 gallons per day to the west-northwest. The estimated potential distance the groundwater could travel in twenty-five years may be 500 to 1000 feet.

These estimates of groundwater flow are based on (1) average site conditions as estimated from the information obtained during this investigation, and (2) the assumption that the average conditions are uniformly representative across the site. The actual conditions at any location on the site will vary from the estimated average conditions, and we expect that our estimates will change as additional information about the site conditions becomes available. Using the maximum permeability measured during this investigation, the distance traveled by the groundwater would be increased by a factor of three (i.e., 1500 to 3000 feet).

The actual distance traveled by groundwater contaminants is expected to be mitigated by soil sorption. Silty clay soils have a high affinity for organic compounds. Because of the low solubility of organic pesticides in water and the estimated slow rate of groundwater movement, organics from any potential recent sources are likely to be contained in the general vicinity of the source.

The contaminant flux or the mass flow rate of contaminants in the groundwater was estimated by two methods:

1. The concentrations of all the organic pesticides detected in

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wells OWC-6, 7, 8, 10 and 11 were summed and an average concentration was calculated. The contaminant flux using this average concentration is estimated to be less than approximately 1 gram per day.

2. The concentrations of total organic carbon in wells OWC-6, 7, 8, 10 and 11 were averaged since total organic carbon would include the organic pesticides, organic carrier materials, and miscellaneous organics in the groundwater. On this basis the contaminant flux is estimated to be less than approximately 100 grams per day.

These estimates of contaminant flux are based on the groundwater flow estimates discussed above and the average concentrations of pesticides and total organic carbon from a limited number of groundwater samples. We expect our estimates of contaminant flux will change as additional information about the actual site conditions becomes available. The installation of additional wells, additional sampling and chemical analyses including permeability testing could indicate anomalies at the site, which would significantly affect our estimate of groundwater flow and contaminant flux.

Based on the analyses of the groundwater samples obtained from the monitoring wells installed to date, it appears that the migration of organic and arsenic compounds may still be contained on site. However, the installation of additional wells along the north property line is recommended to better monitor flow across this boundary.

While precautions have been taken to obtain representative groundwater samples, this site assessment is nonetheless based on the analyses

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of a single set of groundwater samples obtained at one point in time.

The recommendations presented include the installation of four additional wells and additional sets of groundwater analyses to confirm the evaluation of groundwater conditions presented in this report.

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Recommendations have been presented for the development of a remedial action program to remove or contain sources of continued contamination present on site. Such a program would be designed based on the results of the proposed soil survey and groundwater studies.

#### INTRODUCTION AND SCOPE OF WORK

This report presents the results of our groundwater evaluation and hydrogeologic investigation conducted at the Ortho-Chevron Chemical Company Plant in Maryland Heights, Missouri. The field work was conducted from January 19 to February 27, 1981, as authorized by the Chevron Chemical Company, Mr. R. B. Macauley, Project Manager, and by letter from Mr. S. H. Kanes dated January 19, 1981. The purposes of this investigation were to:

- 1. Evaluate the potential contamination of the soil and groundwater as a result of past production activities and on-site disposal of waste materials;
- 2. Evaluate the potential magnitude and extent of contaminant migration;
- 3. Select samples for analysis and classification as hazardous waste materials; and
- 4. Assess site conditions with respect to government regulations and recommended water quality criteria.

Existing geological information was reviewed prior to the field investigation. During the field investigation, borings were drilled at thirty-four locations on the site to obtain soil samples which were retained for engineering classification and, if required, chemical analyses. Six boring locations were added during the field investigation to the proposed boring locations at the request of Chevron. Soil samples were also obtained at Chevron's request from a soil-debris waste pile on site. Fifteen of the soil borings were completed as groundwater observation

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wells including three sets of nested wells. The nested wells consist of two separate wells, installed at approximately the same location, with the screened portion of the wells installed over different depths within the same aquifer or installed in two separate aquifers or geologic formations. Field permeability tests were conducted in selected wells, water levels were monitored, and groundwater samples were obtained for chemical analyses.

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The evaluation and management of surface water at the site and recommendations on design of remedial work for the control of contaminated groundwater including additional groundwater monitoring was outside the scope of this project. If such work were required, we would be prepared to assist Chevron with the design and implementation of remedial works, continuation of groundwater monitoring, personnel training, reviews with regulatory groups, and additional site evaluations as appropriate.

#### SITE DESCRIPTION

The Ortho-Chevron Chemical Company Plant is located along Adie Road in Maryland Heights, Missouri, as shown in Figure 1. A general site plan showing the layout of the plant is presented in Figure 2. Surface elevations at the site vary from a high of approximately 540 at the east side of the site to elevation 510 at the west. Surface drainage is generally to the west/northwest and a well-defined but intermittent drainage way flows from south to north near the west end of the site. The plant site is located in a drainage basin which is a tributary to Fee Fee Creek which in turn is a tributary to the Missouri River.

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We understand that production processes at the plant are generally limited to formulating and packaging organic pesticides. Raw materials and finished goods are shipped to and from the site by rail and truck. Plant facilities include office buildings, a shower and lunchroom building, storage tanks, and two series of production buildings along two rail spurs. A small storm water retention pond is located near the northwest corner of the site.

The Ortho-Chevron Chemical Company has been operating at this site for approximately twenty-five years. Based on our previous geotechnical investigations at this site and conversations with plant personnel, we understand that leaks and spills of pesticides and carrier products have occurred in the past. We also understand that past practice may have included on-site disposal of certain waste materials, including the burial of debris from a previous fire. Several of the borings added during the field investigation were intended to investigate potential locations of buried materials.

The plant is located in an established industrial area. Immediately southeast and topographically and hydraulically upgradient from the plant is an abandoned brick-clay mine, see Figure 1. Until recently the abandoned mine was used as a St. Louis County sanitary landfill. The landfill is now closed and has a soil cover; however, the cover appears thin and vegetative cover is minimal. Air photographs taken in 1961 indicate a mined area of approximately 27 acres. We were not able to determine the acreage and depth of the mine at the time it was abandoned

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and landfilling began. The landfill is a potentially large groundwater recharge source and may contribute to the high groundwater levels encountered at the Ortho-Chevron Plant site. Qdors of gas escaping from the landfill can be detected adjacent to the landfill, especially on warm days. It is not known if any monitoring wells exist at the landfill. Groundwater monitoring wells were not observed along the perimeter of the landfill.

Immediately east and also topographically and hydraulically upgradient of the Ortho-Chevron Plant is a long established fertilizer plant, see Figure 1. Various other small industrial and commercial operations are located in the general area of the plant.

A field survey was made last fall by Mr. William Prosser (WCC) to determine if shallow water supply wells are in use within the general vicinity of the plant. A search was made of the Missouri Geological Survey records and personal interviews were conducted with people working or residing within one-fourth mile of the plant. A total of six wells were located in Sections 23 and 26 T.46N, R.5E. None of the wells identified is within one-fourth mile of the plant site. The wells vary in depth from 140 feet to 325 feet and penetrate through the Ste. Genevieve Limestone into the St. Louis Limestone formation and in some cases into the Spergen Formation. The available details for each well are summarized in Table 1.

#### FIELD INVESTIGATION

### Exploratory Borings

Thirty-four borings were drilled at locations shown on the site plan, Figure 2. The borings were advanced to depths of up to 69.5 feet

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using a truck-mounted 8-inch-diameter continuous-flight auger drill rig.

Soil samples were obtained at selected depths by hydraulically pushing a

2-inch-I.D. liner-tube sampling device. Samples of the rock encountered

at the site were obtained from borings OWC-2 and OWC-12 using an NX
sized double-tube core barrel. The borings were located in the field

based upon the topographic map provided by Ortho-Chevron and were drilled

under the supervision of Woodward-Clyde Consultants' geologist or engineer.

Grade elevations at the boring locations were surveyed by Woodward-Clyde

Consultants using the established bench marks located on the site.

Elevations of ground surface and changes in soil strata are rounded to

the nearest foot.

During the field investigation, 233 soil samples (approximately seven samples per boring) were obtained. The samples were returned to our office and extruded at the end of the day or, when requested, the samples were extruded in the field for viewing by Ortho-Chevron personnel. Once extruded, the samples were placed in glass jars which had been previously rinsed with an organic solvent (acetone) to prevent outside contamination. In the event that future examination of the samples is required, samples obtained at depths of less than 20 feet are currently stored under refrigeration at our office in St. Louis. Samples obtained at depths greater than 20 feet and samples selected for chemical analyses were shipped on ice to Wilson Laboratories in Salina, Kansas, where they are also stored under refrigeration. All samples will be refrigerated and stored until our services are terminated, after which they will be relinquished to Ortho-Chevron.

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Logs of the borings were prepared based upon observations of the auger cuttings, drilling characteristics, and recovered samples. The logs were subsequently modified, as necessary, based on the laboratory test results. The detailed boring logs are presented in Appendix A. Borings not completed as wells were pumped full with a cement-bentonite grout.

## Observation Well Installations

Fifteen groundwater observation wells were installed at the locations shown on the site plan, Figure 2. The wells range in depth from 17 feet to 69.5 feet in depth. Details of the individual well installations are summarized in Table 2. Individual well profiles are presented in Appendix B.

Borings to be completed as observation wells were advanced with an 8-inch-diameter continuous-flight auger to the selected well depth.

While the boring was being drilled, the slotted PVC well screen sections and the solid PVC riser pipe sections were cemented together. A PVC cap was also cemented to the bottom of the well screen. The pipe was then hoisted by the drill rig and lowered into the boring immediately after the augers had been removed. A well-graded washed river sand was poured into the annular space around the well screen to sufficiently fill the annular space around the screen to a depth of approximately 2 feet above the top of the screen. Bentonite clay pellets were poured into the annular space to form a 3-foot-thick clay seal above the sand. A cement-bentonite grout was pumped into the annular space from the top of a bentonite-pellet seal to within approximately 2 feet of the surface.

Concrete was added to the remaining annular space and a 6-inch-diameter

steel pipe was placed over the well and set into the concrete. The concrete acts to hold the steel protective casing in place and acts as a surface water seal. Each well has a vented PVC cap. Each protective casing is provided with a drain hole drilled approximately 4 inches above the existing grade.

A 1/4-inch-thick 2-inch-wide steel bar was inserted into slots on either side of the protective casing and padlocked into place to prevent unauthorized entry to the wells. One key will open all the locks and sets of keys were left with Mr. Coan and Mr. Holman at the Ortho-Chevron Plant. The protective casings were painted either yellow or black at the discretion of Ortho-Chevron personnel. The appropriate alphanumeric well identification was stenciled on each protective casing in the contrasting color. The wells can be further identified by the press-apply number glued on each well cap.

## Development of Observation Wells

Each well was bailed several times in order to develop the well prior to sampling. The wells were developed to minimize the effects of drilling on the quantity and quality of groundwater recharging the well. The actual number of times each well was bailed prior to sampling is presented in the well summary table, Table 3. The recharge to these wells was relatively slow and each well was bailed essentially dry during development. All wells were drilled without the aid of drilling fluid with the following exceptions:

- 1. OWC-2 and OWC-12 were drilled into the limestone and potable water was pumped into the borings to remove the cuttings and to cool the core barrel; the water was not recirculated:
- 2. Potable water was used to flush the borings for wells OWC-6 and OWC-8 because the borings caved before the well screen could be set.

Precautions were taken to prevent introducing contaminated material into the wells and to prevent cross-contamination of the wells. As an added precaution, an individual bailer was installed in each 4-inch-diameter observation well. The bailers were initially constructed and cleaned in our laboratory and individually sealed in plastic and transferred to the site. A bailer was hung from the cap in each well and that was the only bailer used to develop and sample that well.

The bailers hanging in the wells are approximately 4 feet long and have an inner diameter of 2.5 inches. Each bailer has a capacity of approximately one gallon.

Well OWC-2 has a 1.5-inch-diameter casing which extends to a depth of 69.5 feet. This well has 10 feet of screen, 8 feet of which extends into a massive unweathered limestone, and 2 feet extending into the shale immediately above the limestone. We were able to bail this well essentially dry with a 4-foot-long 3/4-inch-0.D. PVC bailer. Recharge to the well was extremely slow and the water was very muddy. In our opinion, the recharge was primarily drilling fluid and not representative of the groundwater. For this reason, OWC-2 was not sampled for chemical analyses.

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OWC-12 also has a 1.5-inch-diameter casing which extends 8 feet into limestone. However, at this location the limestone appears to be weathered. Clay seams were observed within the recovered rock core. The 2 feet of screen which extends above the limestone is in clay rather than shale at this site. Using a bailer similar to the one used in OWC-2, we were unable to bail this well dry because of the faster rate of recharge. Groundwater samples were obtained from this well for chemical analyses.

## Groundwater Sample Collection

As recommended by the Missouri Department of Natural Resources (1979), in preparation for sampling, each well was flushed, i.e., bailed dry or a volume of water equivalent to a minimum of three times the casing volume was removed, and the well allowed to recharge prior to sampling. To evaluate the hydraulic gradient of the groundwater, the depth to groundwater was measured in each well prior to flushing and sampling. At the time of sampling the following water quality parameters were measured in the field: pH, specific conductivity, and temperature. The results of these field tests are presented in Table 4.

The following samples were obtained from each of the fourteen wells sampled. One small glass vial for total organic carbon (TOC), three one-liter glass bottles for organic analyses, one plastic quart container for metals analyses and one plastic quart container for general water quality analyses.

At each well the bailer was carefully lowered into the water to minimize agitation of the water column. The bailer was withdrawn from

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the well and a small quantity of water was used to rinse the TOC vial and the vial was then filled. A large-mouth plastic bottle used for the field analyses was rinsed and filled. The remaining water in the bailer was used to rinse the three glass bottles and the two plastic containers. The second bailer of water was then drawn and an approximately equal aliquot of water was poured into each sample bottle. This procedure continued until each bottle was completely full. The samples were then immediately placed on ice.

Immediately after the samples were collected, they were returned to our laboratory and the samples collected for metals analyses were filtered through individual 0.45-micron pore-size filters and poured into acid washed, acid preserved, plastic containers in preparation for shipment to the water chemistry laboratory. All samples were then shipped on ice to Wilson Laboratories in Salina, Kansas for analyses. The samples used for organic analyses were filtered through 1.0 micron pore-size glass fiber filters at Wilson Laboratories prior to analyses. The purpose of filtering the samples is to remove suspended solids which if digested or extracted with the sample would contribute non-representative amounts of certain constituents to the groundwater sample. Dissolved solids, not suspended solids, are normally transported by groundwater.

#### GEOLOGIC SETTING

The Ortho-Chevron Plant is located on an eroded gently sloping upland loessial surface within the Fee Fee Creek watershed. Fill

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material was encountered in the borings over a majority of the site.

The fill was generally firm to stiff, brown, low plastic, silty clay which may include construction debris and organic soils in localized areas. The fill varied in thickness with up to 8 feet of fill encountered along the north rail spur.

Firm to stiff, brown, low plastic, silty clay loess was encountered across the entire site beneath the fill. Where the fill material was not encountered, the loess was the surficial soil. The loess was generally 10 to 15 feet thick.

Borings drilled in the northeast half of the site and the northwest corner indicated that the uppermost portion of the loess in these areas had been reworked by water, i.e., stream, pond, or swamp deposits.

These alluvial deposits varied in thickness up to 15 feet and were generally firm to stiff, dark gray to gray, low density, organic silty clays with numerous root holes and small voids.

Bedrock units beneath the loess consist of Pennsylvanian Age strata of the Pleasanton, Marmonton, and Cherokee groups in descending order. These are primarily shales but may also contain cyclic sequences of sandstone, siltstone, and limestone with occasional seams of clay. The beds generally range in thickness from a few inches to several feet. The total thickness of these shale units observed at the site varied from about 5 feet on the west to about 40 feet on the east. In some locations the shale was not present or was completely weathered to clay. In general, a 5-foot-thick, highly plastic, residual clay layer was encountered between the base of the loess and the uppermost shale unit.

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Underlying the shale units is the highly irregular erosional unconformity of the Ste. Genevieve limestone formation of the Mississippian system. The Ste. Genevieve is generally described as dense, massive, and relatively pure limestone.

## Subsurface Profile

The generalized subsurface profile described above has been shown in more detail in four cross-sections which include schematic logs of the borings. Our interpretation of the subsurface profile is shown on these cross-sections presented in Figures 3 through 6.

Hydrogeology

The original or natural surficial soils in this area are classified as the Menfro-Winfield Series by the Soil Conservation Service (1972). The Menfro soils are reported to have moderate infiltration rates when thoroughly wetted. These soils are reported to be generally deep, well drained with moderately fine to moderately coarse textures.

The Winfield soils are reported to have slow infiltration rates when thoroughly wetted and consist generally of soils with moderately fine textures. These soils have a slow rate of water transmission.

Because of the low permeability, the loess retards the infiltration of precipitation and Miller et al. (1974) report that most of the annual precipitation is lost as runoff and evapotranspiration. Wells completed in the loess have very small yields.

A search has been made of the Missouri Geological Survey records which indicates no wells are located within one-fourth mile of the plant site and that the nearest wells range in depth from 140 feet to 325 feet and penetrate the limestone, see Table 1 and Figure 1.

Fuller and Knight (1967) report 5 to 10 gallons per minute may be obtained from the limestone at depths of 250 to 400 feet. Groundwater contained in the bedrock in this area is described as very saline, containing more than 1000 milligrams per liter of total dissolved solids. This salinity increases with depth, with 20,000 to 30,000 milligrams per liter TDS common at 2,000 to 3,000 feet (Fuller and Knight, 1967). While bedrock aquifers may yield adequate supplies of water, the water is generally unusable because of its salinity. Public water supplies in the plant site area are taken from surface water sources such as the Missouri and Meramac Rivers (Missouri Department of Health, 1971).

During our investigation groundwater was encountered in the loess at depths ranging from 2 feet below the surface along the east side of the plant to about 10 feet below the surface in the northwest corner. This water was probably perched on the underlying residual clay and shale which would retard further downward movement. Based on the hydrogeologic conditions at the site and the observed groundwater levels, in our opinion, the groundwater was in an unconfined condition and flowing to the west/northwest. Groundwater levels measured in each well during this investigation are listed in Table 5. A groundwater contour map is presented in Figure 7 which was interpreted from the water levels observed on March 19, 1981.

# Field Permeability Tests

Field permeability tests (slug test) were performed in wells OWC-6, 7, 8, 9, and 15. These are shallow wells screened in the loess. The insitu permeability of the soil in the vicinity of the wells was estimated from the rate of rise or recharge of the water level in the wells after a certain volume or "slug" of water was suddenly removed from the well. The data were plotted and the permeabilities were calculated using a methodology developed by Bouwer and Rice, 1976. Estimated permeabilities calculations are presented in Appendix C. The results of the slug tests are presented in Table 6.

The average estimated permeability was 1 foot per day  $(3 \times 10^{-4})$  centimeters per second) and the range of test results was from about 0.1 to 3 feet per day  $(3 \times 10^{-5})$  to  $1 \times 10^{-3}$  centimeters per second). We expect this average estimated permeability will change as additional permeability tests are performed in other wells at the site. The results from additional tests may indicate the soil is more permeable.

#### LABORATORY TESTING

## **Engineering Index Properties**

Soil samples representative of the four soil strata (i.e., fill, water-modified loess, loess and residual clay) encountered at the site were selected for general engineering index property testing. For continuity, the samples were selected from the same boring, OWC-5. The subsurface profile at this location was typical for the site. Laboratory tests included visual classification, natural water content, liquid

limit, plastic limit, and grain size distribution. The test results are presented in Appendix D.

## Soil Chemistry

Arsenic. The results of selected soil samples analyzed for arsenic are presented in Table 7. Six soil samples from Boring B-219 ranging in depth from 2 feet to 21.5 feet were submitted to Wilson Laboratories for arsenic analysis. Boring 219 was drilled on the north rail spur where in the past hopper cars of arsenic were unloaded with open conveyors. Two soil samples from Boring B-203 at 5 and 10-foot depths were also submitted for arsenic analysis. A soil sample from OWC-10 at a depth of 4 to 5.5 feet and a soil sample from OWC-11 at a depth of 1 to 2.5 feet were also analyzed for arsenic in addition to organic pesticides. The samples were reduced and analyzed for production of arsine gas.

Organic Pesticides. Certain organic pesticide analyses contained in the list in Table 8 were performed on selected soil samples. The results of these analyses are presented in Tables 9 and 10. Soil samples were selected from borings OWC-10 and OWC-11 for analyses of organic pesticides. In order to provide some indication of the maximum concentrations which might be expected at the site, we initially selected and analyzed samples which we suspected to be most contaminated. Borings OWC-10 and OWC-11 were drilled at locations with high potential for contamination and the samples selected (one from each boring) had an organic odor.

The samples were submitted to Wilson Laboratories where they were prepared and analyzed.

The results of the organo-chlorine pesticides analysis for the sample taken from OWC-10 at a depth of 4 to 5.5 feet are presented in

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Table 9. The results for the organo-chlorine pesticides analysis for the sample taken from OWC-11 at a depth of 1 to 2.5 feet are presented in Table 10. The laboratory reported Kelthane did not elute properly from the gas chromatagraph and could not be analyzed in the samples. The samples were also analyzed for arsenic and the results are shown on the respective tables.

Extraction Procedure Toxicity. Three samples were submitted to the laboratory for EP toxicity chemical analyses. The results of these analyses are presented in Table 11 and in Appendix E. One composite sample was taken from the soil, rock, and construction debris waste pile and the other two samples were taken from Boring B-212 in the natural soil and sediments from the storm water surface impoundment (pond).

The waste pile sample was a representative sample composited from samples obtained from four hand-augered holes approximately 3 feet deep and one 4-foot deep test pit. Attempts were made to auger deeper at several locations; they were unsuccessful because of the rocks and debris in the pile. The waste material sampled in the waste pile passed the EP toxicity test and is not classified hazardous based on that method. Consideration should be given to hazardous classifications resulting from listing of specific wastes or processes.

The storm water retention pond was empty at the time of our investigation, but because of the soft bottom sediments a ramp was built out into the pond to permit sampling. The ramp was about 3 feet thick; sampling was started at 3 feet. Samples were collected at 3.0 to 4.5 feet, 5.0 to 6.5 feet, 7.0 to 8.5 feet and at selected depths down to 21.5 feet

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below the top of the ramp. The samples at 3 feet and 7 feet were selected for EP toxicity analyses. The sample at 3 feet was representative of the near-surface pond sediments. The sample at 7 feet was from the soil immediately below the sediments. Both samples passed the EP toxicity test; however, if the soil or sediments are intended for disposal and have been contaminated with a listed hazardous waste, they may be defined as a hazardous waste and may be subject to the hazardous waste management regulations.

## Groundwater Chemistry

Groundwater samples collected from fourteen observation wells were analyzed by Wilson Laboratories for organics, metals, total organic carbon, and general water quality parameters. Well OWC-2 was not sampled because the well did not recharge sufficiently to allow proper development; the water it contained was not considered representative groundwater. The distribution of each major parameter analyzed in the groundwater is presented in Figures 8 to 36. The complete results of water quality analyses performed on this set of groundwater samples are presented in Appendix F. Results of the organic analyses and selected inorganic analyses are summarized in Table 12. EPA drinking water standards and Missouri groundwater recharge standards are shown for comparison.

The groundwater samples were analyzed for the organic compounds shown in Table 8 with the exception of Kelthane, Trithion, and Sevin.

The samples could not be analyzed for Kelthane because Kelthane did not elute properly from the gas chromatagraph. A standard for Trithion analysis was ordered by Wilson Laboratories but was not received in time

to analyze the samples. Unidentified peaks were not observed in the analyses of the organo-phosphorous pesticides which would indicate that Trithion-was not present. See Appendix G for a discussion of the laboratory analyses.

It was anticipated that Sevin could be analyzed with the organophosphorous pesticides on a nitrogen-phosphorous gas chromatagraph
detector. However, analyses of the samples indicated that interferences
were present which precluded the use of the nitrogen-phosphorous detector.
The samples were then analyzed with a highly selective flame photometric
detector operated in the phosphorous mode. Six phosphorous containing
compounds were detected but the laboratory was unable to detect Sevin
because the detector was not sensitive to nitrogen-containing compounds.

### DISCUSSION OF RESULTS

Significant concentrations of arsenic and organic pesticides were identified in certain near-surface samples of soil and in groundwater samples obtained from observation wells located within and downgradient from the central plant processing area. Groundwater is considered to be the primary transport mechanism for potential movement of these contaminants across and off the site. Where high concentrations of arsenic or pesticides exist in uncovered near-surface soils, additional transport mechanisms exist including: (1) erosion and surface runoff in storm water, (2) wind erosion, and (3) leaching of the affected soil by infiltration of precipitation.

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This initial assessment of site conditions has focused primarily on potential contamination and contaminant movement within the groundwater regime. Selected soil samples were analyzed to evaluate hazardous waste characteristics by EP Toxicity and total extractions were performed on other suspected contaminated soil samples to determine the levels and presence of various pesticides. Results of the specific findings are discussed below and recommendations are presented to survey the potential sources of contamination on site.

Following a survey of the sources of contamination, recommendations have been provided for the development of a program to remove or contain the identified sources.

## Soil Contamination

Arsenic. A railroad unloading facility consisting of an open conveyor for bulk transport of arsenic was previously operated near the location of boring B-219 on the north side of the plant site. Soil samples obtained from boring B-219 were found to contain arsenic at the concentrations shown in Table 7. Arsenic concentrations decreased sharply with depth in Boring 219 from 480 ppm at 2 feet to approximately 3 to 6 ppm below 10 feet. Boring 219 was not completed as an observation well to eliminate the risk of providing a direct route to the groundwater in the event of spills or leaks from railroad cars parked on the tracks.

The background levels of arsenic in the loess soils are unknown at this time. Soil samples obtained at two depths in boring B-203 which was drilled near the southwest corner of the site indicate total arsenic

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concentrations of approximately 5 ppm which is similar to the concentrations at depths below 10 feet at the unloading facility. However, groundwater and wind transport of arsenic may have affected the arsenic content of soils in the plant vicinity. Soils from natural parent materials may have background arsenic levels approximately 1000 times less than the 5 ppm of arsenic found in soils at depth at this site. Additional samples of similar loess soils from off the site may be analyzed to confirm background levels.

Boring OWC-11 was drilled in an area which is now paved with asphalt to the west and downgradient from the arsenic processing facility. One soil sample obtained at a depth from 1 to 2.5 feet below the asphalt was selected for analysis of organic pesticides and arsenic. The appearance and odor of the sample indicated that this was potentially one of the more contaminated locations encountered at the site. The total arsenic in the sample was analyzed at 570 ppm, similar to the 480 ppm at 2 feet in Boring 219. The arsenic concentration in the groundwater sample obtained from well OWC-11 was measured at 0.11 mg/1.

A single soil sample from a depth of 4 to 5.5 feet was also analyzed from Boring OWC-10 located in the central processing area of the plant near where leaks in an underground pipeline were reported. This sample was analyzed for organic pesticides and arsenic. The concentration of arsenic in the soil was 5.5 ppm. The arsenic concentration in the groundwater sample obtained from well OWC-10 was measured at .006 mg/l.

Waste soils generated on site during construction activities should be evaluated to determine if they are considered hazardous wastes as a

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result of arsenic or other pesticide contamination. The EP Toxicity test as one indicator of hazardous waste does not typically extract the total constituents from a sample and there is a dilution effect of the extract. Direct comparisons cannot be made between the total concentrations of arsenic or pesticides in the soil samples and the concentrations in the extract of the EP Toxicity analyses. Regardless of the EP Toxicity analyses, waste soils may be considered a hazardous waste if they are contaminated by specific pesticides listed by EPA.

There are no known regulations or standards for allowable limits of arsenic or other pesticides in soils which are not considered a waste material. However, significant concentrations of arsenic in near-surface soils are likely to migrate into the environment. A survey of near-surface soils is recommended to define sources of contamination so that effective containment procedures can be developed. The formulation procedures used in preparing arsenic pesticides should be determined. If arseno-organic formulations were prepared, the arsenic may be in a more soluble form than if it was prepared in a dust form.

Organic Pesticides. Two soil samples, one each from Borings OWC-10 and OWC-11, which were suspected to be contaminated were submitted to the laboratory for organic pesticide analyses. The test results are presented in Tables 9 and 10. As per Ortho-Chevron's instructions, when relatively high concentrations or organo-chlorine pesticides were encountered, analyses for the remaining organic pesticides were discontinued. With the exception of the hazardous waste management regulations (RCRA),

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there are no known regulations or standards for acceptable levels of pesticides in soils which are not considered waste materials.

As was recommended for evaluation of arsenic concentrations, a survey of near surface soils should include analysis for organic pesticides. Composite samples may be considered as a screening mechanism to reduce the cost of laboratory analyses. Analyses should include all persistent pesticide compounds that might reasonably be expected to be present in the soils on site.

Remedial work required to remove, cover or isolate sources of contamination may be developed following the soil survey. Soils intended for disposal which are known to be contaminated by specific listed pesticides are considered hazardous wastes and are subject to the hazardous waste management regulations. Details of these requirements are contained in pages 33120 to 33127 of the <u>Federal Register</u>, Volume 45, No. 98, dated Monday, May 19, 1980, and as amended November 12, 19, and 25, 1980.

Extraction Procedure Toxicity. Three soil samples were submitted to Wilson Laboratories for EP toxicity testing. One representative composite sample was obtained from the soil, rock and construction debris waste pile on site; two representative soil samples were obtained from the storm water retention pond. In the storm water retention pond one sample was obtained from the near-surface bottom sediments. A second sample was taken from the soil just below the bottom sediments (approximately 4 feet below the pond bottom).

The test results for the EP toxicity analyses are presented in Table 11. The results indicate that the soils are not hazardous as defined by the EP toxicity test.

The concentration in the soil of other organic pesticides which are not analyzed in the EP toxicity test may be relatively high and may be determined by additional chemical analyses. Precautions should be taken when handling or disposing of this material.

## Groundwater Contamination

Groundwater samples from fourteen observation wells were analyzed for organic pesticides, total organic carbon, metals, and general water quality parameters listed in Table 8. The analytical results for each well are presented in Appendix F. The general lack of apparent continuity of detectable organic pesticides between wells indicates that isolated, individual sources of contamination exist rather than a single source. Distributions of the organic pesticides, metals, TOC, and selected water quality parameters, as measured in each well, are presented in Figures 8 to 36. The following organic pesticide compounds were analyzed for and were not detected in any of the groundwater samples:

Chlordane
Chlorobenzilate
Toxaphene
Captan
Methoxychlor
Difolatan
Guthion

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The analytical results for the groundwater samples obtained in the upgradient wells OWC-1 and OWC-9 indicate that the groundwater entering the site was relatively uncontaminated by materials which were handled on the plant site; however, low concentrations of Aldrin, Lindane, and 2,4-D were present in the sample from OWC-1 and low concentrations of DDE, DDT, Aldrin, Dieldrin, and Lindane were present in the sample obtained from OWC-9.

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Well OWC-3 also appears to be relatively uncontaminated. Lindane and 2,4,5-T at low concentrations were present in the sample. Leaks and spills from the truck and rail traffic in the immediate vicinities of wells OWC-1, 9 and 3 may represent a potential source of contaminants. Wind-borne particulates may also be a contributing factor, particularly where material may have been stored or incinerated in this area.

At this time there appears to be no apparent influence on the groundwater entering the site due to the sanitary landfill and fertilizer plant, both of which are upgradient from this site. The concentrations of the general water quality parameters which would indicate outside influences were relatively low. We were not able to locate representative background water quality data from any similar local wells completed in the loess. No known local water supply wells have been completed in the loess because of the low transmissibilities.

In general, the water quality is hard to very hard with relatively high dissolved solids which could make it unsuitable for use as a potable water supply or for certain industrial processes. The groundwater

has a relatively high concentration of manganese which has no apparent toxic properties at this concentration but it may cause stains and deposits on fixtures. The water is also slightly corrosive to corrosive and may cause attack on metal piping. Installation of subsurface piping should include a corrosion protection system.

Wells OWC-3 and 4 are located along Adie Road. Surface runoff contained in the ditch on Adie Road is a potential source of groundwater recharge. During our investigation it was noted that the drainage in this ditch was very poor and that the water had a tendency to pond in the vicinity of well OWC-4. The higher chloride concentrations in wells OWC-3 and 4 may be the result of salt used to de-ice the roads. We also observed that the pavement runoff in the area of the loading docks on the south side of Buildings B and E drains into the ditch along Adie Road. Leaks and spills on this pavement which were not totally removed may account for some of the Mirex, Heptachlor, Lindane, 2,4-D, and 2,4,5-T observed in OWC-4.

The highest concentrations measured in the groundwater were generally measured in the area of wells OWC-6, 7, 8, 10, and 11. The wells in this central processing and storage area of the plant had the highest frequency of detectable organic pesticide compounds. Based on our observations of the soil samples obtained during the field investigation, results of the soil and groundwater chemical analyses, and discussions with plant personnel, this area was apparently the site of leaks and spills from buried piping and surface handling. In the past this area was potentially used as an on-site disposal area, as evidenced by the

waste materials encountered during the excavation of pier foundations for Building G. We understand that these practices which may have resulted in leakage of products into the ground have been eliminated. Underground piping has been raised above ground or replaced with stainless steel pipe and no new sources of subsurface contamination are expected.

A groundwater sample obtained from OWC-13 located to the west and downgradient from the central processing and storage area contained a relatively high concentration of Lindane as shown in <u>Figure 8</u>. The source of the Lindane is unknown; the source may be fire debris reported to have been buried on site or an old spill or leak in the processing area.

The rock core obtained from boring OWC-12 indicated the limestone in this area was moderately weathered and six 1- to 2-inch-thick clay seams were encountered in the top 4 feet of the rock. After each bailing the recharge to the well was relatively fast and clean. Groundwater samples were obtained for analyses. In our opinion, the shale and residual clay deposits at this site should provide an effective barrier action to contaminant movement from the shallow groundwater into the limestone. This was partially confirmed by the poor recharge into well OWC-2 which also penetrates into the limestone. However, a wide variety of organic pesticide compounds were detected in well OWC-12. Potential transport mechanisms for movement of pesticides into the limestone bedrock may include:

1. Piers for building foundations which may penetrate through the

clay into the limestone. Woodward-Clyde Consultants provided field inspection for the piers installed for Building G (WCC report S79-9). The piers for Building G were installed through 15 feet of contaminated fill which included buried waste materials. The thirteen piers were 30 inches in diameter and extended to a depth of approximately 30 feet. Daily field reports indicate the piers are bearing on the limestone. Our soil and foundation report for the Maintenance Shop (S78-55) recommended smaller diameter piers for this building to bear in the residual clay. Information on the foundation conditions of the remaining structures was unavailable.

- 2. Bore holes from previous soil investigations penetrate into limestone. They may not have been adequately plugged.
- 3. The residual clay may be discontinuous in the areas of the old north-south stream channel which was observed to have existed between grid lines 600W to 800W on the site plan presented in Figure 2. The residual clay was formed from the parent shale deposits at the site which were exposed to the elements and weathered. Shale is a sedimentary deposit which is generally deposited in horizontal beds. At this site the shale was deposited to at least elevation 525 as encountered in boring OWC-2. The upper portion of the shale was weathered to clay and apparently eroded from the site, potentially by an ancient stream. Near the middle of the site the shale has been eroded down to at least elevation 490 as encountered in Boring 210. The shale in this area is completely weathered to clay which is generally less than 10 feet thick over the limestone. The potential exists that an ancient stream channel may have

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completely eroded the clay-shale deposit exposing the limestone over a portion of the site. Finally the wind-blown silty clay (loess) was deposited over the weathered eroded shale deposit resulting in the geologic profile encountered at the site.

4. The residual clay and shale may have a macro-structure (joints or desiccation crack remnants) that permits seepage.

The groundwater samples obtained from the downgradient wells OWC-14 and 15 were relatively uncontaminated, indicating the effects of ground-water recharge from the storm water retention pond appear to be relatively insignificant. Low concentrations of Aldrin, Dieldrin, and Lindane were detected in OWC-14. Only Dieldrin and Lindane at very low concentrations were detected in OWC-15.

The complete analytical results for each well are presented in Appendix F. Table 12 presents the results of the organic analyses and selected inorganic analyses for each well and, for comparison, EPA drinking water standards and Missouri groundwater recharge standards.

Potential Waste Migration

Figure 7 shows the groundwater contour map interpreted from ground-water levels observed during the period of this study. Water levels indicate the general direction of flow to the west-northwest with an average gradient across the site of approximately 0.021 foot per foot. The average permeability of the soil is estimated at less than 1 foot per day based on the field permeability or slug tests performed in selected wells at the site. Assuming a soil porosity of 30 percent, the actual velocity of the pore water is estimated to be much less than

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I foot per day. Assuming these are average conditions, we estimate the groundwater would flow approximately 500 to 1000 feet in twenty-five years toward the west-northwest.

These estimates of groundwater flow are based on (1) average site conditions as estimated from the information obtained during this investigation, and (2) the assumption that the average conditions are uniformly representative across the site. The actual conditions at any location on the site will vary from the estimated average conditions, and we expect that our estimates will change as additional information about the site conditions becomes available. Using the maximum permeability measured during this investigation, the distance traveled by the groundwater would be increased by a factor of three (i.e., 1500 to 3000 feet).

The actual rate and quantity of pesticides and arsenic movement in the groundwater is mitigated by soil attenuation. The silty clay soil at this site has a high affinity for organic pesticides and the rate of groundwater movement is slow enough to allow the soil to sorb some of the pesticides as they flow through the soil. The low solubility of the pesticide compounds also limits the quantity of contaminants which can be dissolved in the groundwater. Finally, the time rate of loading will affect how far the contamination has moved. The more recent loadings have not had time to move very far and, therefore, much of the contamination may be contained in the near vicinity of the source.

The contaminant flux or the mass flow rate of the pesticides including arsenic is a function of the groundwater flow rate, the concentration of

the contaminant and the sorption potential of the soil through which the water flows. Because of the apparent isolated individual sources of contaminants, the concentrations for all detected organic pesticides, in the wells where the higher concentrations were measured (i.e., OWC-6, 7, 8, 10, and 11), were averaged to estimate the potential contaminant loading. Alternatively, since the levels of total organic carbon (TOC) include the organic pesticides in addition to the organic carrier materials and other miscellaneous organics in the groundwater, these values have also been averaged for the same wells and used as another estimate of the potential loading. The average concentration for the organic pesticides detected in the groundwater in the selected area is estimated at 0.16 ppm. The average concentration for total organic carbon is 46 ppm.

Based on our hydrogeologic investigation and assuming a contaminant plume width of approximately 200 feet, the groundwater flow rate is estimated at about 600 gallons per day. Based on the average concentration for the organic pesticides presented above, we estimate the net organic pesticide contaminant loading may be less than about 1 gram per day. Based on the average concentration for TOC presented above, the net contaminant loading may be less than about 100 grams per day.

These estimates of contaminant flux are based on the groundwater flow estimates discussed above and the average concentrations of pesticides and total organic carbon from a limited number of groundwater samples. We expect our estimates of contaminant flux will change as additional information about the actual site conditions becomes available. The installation of additional wells, additional sampling and chemical

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analyses including permeability testing could indicate anomalies at the site, which would significantly affect our estimates of groundwater flow and contaminant flux.

### RECOMMENDATIONS

Based on our field investigation, laboratory tests, analysis, and prior experience we present the following recommendations for your consideration. We will be pleased to discuss these recommendations with you and to develop a work program to implement these recommendations as you desire.

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1. Significant concentrations of arsenic and organic pesticides have been encountered in soil samples obtained on site. We recommend that an additional survey be made of the near-surface soils to identify zones where higher concentrations of arsenic and pesticides are present. The survey may be established in a grid format with samples composited from the upper approximately 1½ feet. Particular attention should be given to expected source areas based upon the results of the contamination distributions in the groundwater. Composite samples made up from several shallow borings may be used as an initial screening program for organic pesticides in order to limit the cost of analyses. Analyses should be made for all persistent pesticide compounds which may be present on the site. Following the evaluation of the analytical results, a remedial action program, if required, could be developed and implemented in cooperation with the EPA.

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- 2. Although every precaution was taken to obtain representative samples of the groundwater, the interpretations, assessments, and evaluation presented in this report are based on a single set of analyses performed on one set of groundwater samples obtained at one point in time. To confirm this assessment of the site conditions, we recommend that the observation wells continue to be flushed and that two additional sets of groundwater samples be collected and analyzed on approximately monthly intervals.
- 3. We recommend that four additional observation wells be installed along the northern property line between OWC-14 and B-219. Two of the wells may be installed in the loess to evaluate potential migration of arsenic and organic pesticides in the groundwater from the observed areas of contamination in the processing areas. The present location of observation wells does not allow an assessment of groundwater quality northwest of the area of known contamination. One well may be installed into the shallow limestone along the property line north of OWC-12 to evaluate the movement of pesticides in the limestone bedrock. One additional well may be installed deeper into the limestone to evaluate vertical movement of pesticides in the bedrock.
- 4. Additional review is recommended to determine the hazardous nature of the materials in the soil pile and pond sediments. The EP toxicity tests gave negative results; however, wasted soils which contain specific listed hazardous wastes are considered hazardous wastes and are subject to the hazardous waste regulations.

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Care should be exercised in disposal of materials containing 5. arsenic or pesticides which are not considered to be hazardous wastes. Additional chemical analyses are recommended to characterize the contaminants and to help evaluate the disposal procedures appropriate for these wastes.

#### LIMITATIONS

The boring logs depict subsurface conditions for the indicated locations and dates. With the passage of time, changes in the subsurface conditions may occur especially with respect to groundwater. Observation wells were located around the site to obtain a general characterization of the groundwater quality. Additional wells, permeability testing, and sampling and chemical testing are required to better define average site conditions and conditions at specific locations on the site. We request the opportunity to re-evaluate the field conditions and our interpretations relative to the design or implementation of any remedial measures if additional site information becomes available or if a significant time interval has elapsed from the date of this study.

### **REFERENCES**

- Bouwer, Herman, and Rice, R. C. 1976, in American Water Resources Research. American Geophysical Union, Volume 12, No. 3, p. 423-428.
- Fuller, Dale L., and Knight, Robert D. 1967, in Ground Water and Water Resources of Missouri. Missouri Geological Survey and Water Resources, Volume 43, p. 295 and 299.
- Miller, Don E. et al, 1974. <u>Water Resources of the St. Louis Area, Missouri</u>. Missouri Geological Survey and Water Resources. Water Resources Report, p. 53, 54 and 55.
- Missouri Department of Natural Resources, March 13, 1979. "Sanitary Landfill Monitoring Guidelines," Solid Waste Management Program Bulletin.
- Missouri Division of Health, 1971. <u>Census of Public Water Supplies in Missouri</u>, 1971, p. 40.
- Soil Conservation Service, 1972. Hydrology <u>in</u> National Engineering Handbook, Section 4, USDA.

#### **GLOSSARY**

Part per million, ppm - a measure of proportion by weight, equivalent to a unit weight of solute per million  $(10^6)$  unit weights of solution.

Note - A part per million is generally considered equivalent to a milligram per liter, but this is not precise. A part per million is equivalent to a milligram of solute per kilogram of solution.

Part per billion, ppb - a measure of proportion by weight, equivalent to a unit weight of solute per billion  $(10^9)$  unit weights of solution.

Milligram per liter, mg/l - a weight-volume measurement which expresses the concentration of a solute in milligrams ( $10^{-3}$  grams) in a liter of solution.

Microgram per liter, ug/l - a weight-volume measurement which expresses the concentration of a solute in micrograms ( $10^{-6}$  grams) in a liter of solution.

Micron, um - a micron is a unit of length; l micron equals  $10^{-6}$  meters (0.000001 meters). When used to describe a filter membrane, such as 0.45 micron pore-size membrane, the length refers to the nominal pore diameter.

TABLE 1

REPORTED DETAILS OF EXISTING WATER SUPPLY WELLS SECTIONS 23 AND 26, T. 46 N., R.5E.

| Well<br>No.* | Missouri<br>Survey No. | <u>Owner</u>               | Section | Date<br>Drilled | Surface<br>Elevation | Total<br>Depth(ft) | Reported Static<br>Water Level In<br>Feet Below<br>Ground Surface | Productivity gallons/minute |
|--------------|------------------------|----------------------------|---------|-----------------|----------------------|--------------------|---|-----------------------------|
| 1            | 8090                   | Maryland Heights<br>School | 23      | 1943            | 595                  | 250                | - 86  | 109<br>(85-foot drawdown)   |
| 2            | 8478                   | J. Pierlow                 | 26      | 1943            | 548                  | 325                | 31  | 1.5                         |
| 3            | 10593                  | J. L. Tennant              | 26      | 1948            | 538                  | 285                | 60  | 5                           |
| 4            | 10598                  | L. Hageman &<br>F. Schiell | 26      | 1948            | 555                  | 285                | 60  | 4.5                         |
| 5            | 25256                  | E. Morrison                | 26      | 1967            | 526                  | 305                | 20  | 8+                          |
| 6            | 25364                  | M. Montgomery              | 26      | 1967            | 506                  | 140                |   | 80+                         |
|              |                        |                            |         |                 |                      |                    |   |                             |

<sup>\*</sup> Numbers indicate well locations shown on the site location plan, Figure 1.

Data obtained from the files of the Missouri Geological Survey.

TABLE 2
OBSERVATION WELL INSTALLATION DETAILS

| Well<br>Designation                            | Elevation of<br>Protective<br>Casing (feet) | Elevation<br>of Ground<br>Surface*(feet) | Casing<br>Diameter<br>(inches) | Well<br>Depth<br>(feet)        | Depth Over Which<br>Well is Screened<br>or Sand Packed**               | Screen Slot<br>Width<br>(inches)     |
|--|---|--|--------------------------------|--------------------------------|--|--------------------------------------|
| OWC-1<br>OWC-2<br>OWC-3<br>OWC-4<br>OWC-5      | 543.7<br>542.3<br>532.0<br>521.4<br>518.1   | 541<br>541<br>529<br>519<br>515          | 4<br>1.5<br>4<br>4             | 23<br>69.5<br>35<br>29.5<br>25 | 10.5 - 23.0<br>56.5 - 69.5<br>13.0 - 35.0<br>8.5 - 29.5<br>12.0 - 26.5 | 0.02<br>0.03<br>0.02<br>0.02<br>0.02 |
| OWC-6<br>OWC-7<br>OWC-8<br>OWC-9<br>OWC-10     | 525.6<br>525.3<br>525.7<br>534.8<br>530.1   | 523<br>523<br>523<br>532<br>528          | 4<br>4<br>4<br>4<br>4          | 25<br>17<br>27.5<br>32<br>28   | 7.0 - 26.5<br>4.5 - 17.0<br>16.5 - 27.5<br>9.5 - 32.0<br>10.0 - 28.0   | 0.02<br>0.02<br>0.02<br>0.02<br>0.02 |
| OWC-11<br>OWC-12<br>OWC-13<br>OWC-14<br>OWC-15 | 526.2<br>526.5<br>518.8<br>515.0<br>516.5   | 524<br>524<br>516<br>513<br>514          | 4<br>1.5<br>4<br>4             | 28<br>40.3<br>20<br>22<br>20   | 16.0 - 28.0<br>28.25 - 40.25<br>8.0 - 21.5<br>9.0 - 23.5<br>8.0 - 21.5 | 0.02<br>0.03<br>0.02<br>0.02<br>0.02 |

Elevations based on USC & GS datum.

<sup>\*</sup> Rounded to nearest foot

<sup>\*\*</sup> The lower portion of the well is screened. The sand pack around the screen generally extends 2 to 3 feet above the top of the screen. Refer to Appendix B for individual well profiles.

TABLE 3

DEVELOPING, FLUSHING AND SAMPLING
OF OBSERVATION WELLS

| <u>Well</u> | Number of Times<br>Bailed Prior to<br>Initial Sampling | Date<br>Flushed | Water Elevation<br>Prior to Flushing | Date<br>Sampled | Water Elevation<br>Prior to Sampling |
|-------------|--|-----------------|--------------------------------------|-----------------|--------------------------------------|
| OWC-1       | 3  | 2-24-81         | 537.8                                | 2-26-81         | 537.5                                |
| OWC-2       | 3  | 2-26-81         | 482.8                                | 2-27-81*        | 483.5                                |
| OWC-3       | 4  | 2-24-81         | 522.5                                | 2-26-81         | 522.3                                |
| OWC-4       | L <sub>‡</sub>   | 2-23-81         | 513.1                                | 2-24-81         | 513.0                                |
| OWC-5       | 6  | 2-24-81         | 510.3                                | 2-25-81         | 510.6                                |
| owc-6       | 7  | 2-23-81         | 517.4                                | 2-24-81         | 517.3                                |
| OWC-7       | 3  | 2-23-81         | 517.8                                | 2-24-81         | 517.5                                |
| owc-8       | 2  | 2-23-81         | 518.4                                | 2-24-81         | 518.3                                |
| OWC-9       | $L_{rac{1}{4}}$                                       | 2-24-81         | 529.6                                | 2-26-81         | 529.1                                |
| OWC-10      | 3  | 2-23-81         | 523.4                                | 2-24-81         | 523.0                                |
| OWC-11      | 3  | 2-23-81         | 517.1                                | 2-24-81         | 517.0                                |
| OWC-12      | 3  | 2-25-81         | 516.6                                | 2-26-81         | 516.6                                |
| OWC-13      | 6  | 2-24-81         | 513.1                                | 2-25-81         | 513.4                                |
| OWC-14      | 6  | 2-24-81         | 509.2                                | 2-25-81         | 507.5                                |
| OWC-15      | 6  | 2-24-81         | 505.0                                | 2-25-81         | 505.0                                |

USC & GS elevation datum.

<sup>\*</sup> OWC-2 was not sampled.

TABLE 4
GROUNDWATER PARAMETERS MEASURED DURING SAMPLING

| Well   | _pH_* | Specific<br>Conductivity**<br>mmhos/cm | Temperature** |
|--------|-------|--|---------------|
| OWC-1  | 6.3   | 960<br>1250                            | 12.8          |
| OWC-4  | 6.3   | 1840                                   | 12.1          |
| OWC-5  | 6.5   | 1170                                   | 13.0          |
| OWC-6  | 6.2   | 860                                    | 14.5          |
| OWC-7  | 6.5   | 1480                                   | 14.0          |
| OWC-8  | 6.7   | 1090                                   | 14.5          |
| OWC-9  | 6.7   | 520                                    | 11.5          |
| OWC-10 | 6.3   | 840                                    | 12.4          |
| OWC-11 | 7.0   | 1200                                   | 12.0          |
| OWC-12 | 7.2   | 700                                    | 16.3          |
| OWC-13 | 6.6   | 1170                                   | 13.0          |
| OWC-14 | 6.8   | 860                                    | 13.2          |
| OWC-15 | 6.3   | 295                                    | 16.5          |

<sup>\*</sup> Cole-Parmer Digi-sense LCD pH meter Model No. 5994-10.

<sup>\*\*</sup> Yellow Springs Instrument salinity, conductivity and temperature meter Model No. 33.

TABLE 5

OBSERVED GROUNDWATER LEVELS USGS Elevation (feet)

(1-2) = 2547 /53.7 / 251 NO47.0 245.9 March 1981 February 1981 17 19\_ 27 11 25 23 24 20 21 18 19 17 16 Well No. 12 13 537.4 537.2 537.6 537.6 537.5 537.8 537.8 533.6 534.4\* OWC-1 490.6 491.5 483.5\* 488.2 486.2\* 482.8\* 539.3 OWC-2 522.5 522.3 522.5 522.8 522.7 522.3 522.5 522.3\* 522.1 523.0 OWC-3 510.8 511.3 512.5 512.0 513.1 513.0\* 512.6 513.2 513.1\* OWC-4 511.1 510.8 510.6\* 510.6 510.3 510.6 510.6 509.1\* 510.2 509.8 509.5 OWC-5 516.8 517.1 516.9 517.1 517.4 517.3\* 516.2\* 517.5 517.4 owc-6 515.8 516.2 517.7 517.8 517.7 517.8 517.5\* 517.5\* 517.8 517.7 OWC-7 518.4 518.2 518.2 518.4 518.9 518.4 518.3\* owc-8 529.8 529.7 529.7 529.3 529.6\* 529.1 529.8 529.8 529.6 529.1 529.1\* 0WC-9 523.2 522.8 523.1 523.4 523.4 523.0\* 523.5 523.3 OWC-10 516.7 516.5 516.7 516.8 516.8\* 517.1 517.0\* OWC-11 516.8 516.7 516.6 516.6\* 516.6 516.9 516.7\* 516.7 0WC-12 513.6 513.3 513.5 513.3 513.3 513.1 513.4\* 513.5 512.5\* 513.0 512.8 512.4 OWC-13 509.2 508.9 509.4 509.3 509.2 507.5\* 509.4 509.2 508.9 505.9\* OWC-14 505.2 505.6 505.7 505.0\* 505.0 505.0 505.0 504.8 504.2 504.4\* 504.6 504.8 OWC-15

Water levels measured by WCC personnel using Soil Test electronic water level indicator.

<sup>\*</sup> The well was bailed within twenty-four hours prior to measuring this water level and may not have fully recovered to static level.

TABLE 5 OBSERVED GROUNDWATER LEVELS USGS Elevation (feet)

|                            |                         |                     |                            |                         |                 |                      |                         | TABLE 5              |                 |                         |                            |                            |                          |                          |                         |                         |                         |
|----------------------------|-------------------------|---------------------|----------------------------|-------------------------|-----------------|----------------------|-------------------------|----------------------|-----------------|-------------------------|----------------------------|----------------------------|--------------------------|--------------------------|-------------------------|-------------------------|-------------------------|
|                            |                         |                     |                            |                         |                 | 0                    | BSERVED<br>USGS E       | GROUNDWA<br>levation | (feet)          | LS                      |                            | 1977 ×                     |                          | (3.                      | S140                    | arch 1981               | 1 p                     |
|                            |                         |                     |                            |                         |                 | February             | 1081                    |                      |                 |                         |                            | 77.0                       |                          |                          | 710                     | arch 1981               | •                       |
| Well No.                   | 9                       | 12                  | 13                         | 16                      | 17              | 18                   | 19                      | 20                   | _21             | _23                     | 24                         | 25                         | _26                      | _27                      | _11                     | 17                      | 19                      |
| 0WC-1<br>0WC-2<br>0WC-3    | -                       | :                   | -                          | :                       | -<br>523.0      | -<br>-<br>522.3*     | 533.6                   | 534.4*<br>-<br>522.1 | :<br>:          | 537.8<br>539.3<br>522.3 | 537.8                      | -<br>486.2*<br>-           | 537.5<br>482.8*<br>522.3 | 537.2<br>483.5*<br>522.5 | 537.6<br>488.2<br>522.8 | 537.6<br>490.6<br>522.7 | 537.4<br>491.5<br>522.5 |
| 0WC-4<br>0WC-5<br>0WC-6    | -<br>509.8<br>515.8     | -<br>509.5<br>516.2 | -<br>509.1*<br>516.2*      | -<br>510.2<br>517.5     | 513.2           | 513.1*<br>-<br>517.4 | 510.6                   | 512.6                | -               | 513.1<br>510.6<br>517.4 | 513.0*<br>510.3<br>517.3*  | -<br>510.6*<br>-           | -                        | 512.5<br>510.6<br>517.1  | 512.0<br>-<br>517.1     | 511.3<br>511.1<br>516.9 | 510.8<br>510.8<br>516.8 |
| owc-7<br>owc-8<br>owc-9    | -                       | -<br>-<br>529.1     | -<br>-<br>529.1*           | - s                     | -<br>-<br>529.6 | -<br>-<br>529.8      | -<br>-                  | 517.7                | 517.5*<br>518.9 | 517.8<br>518.4<br>529.8 | 517.5*<br>518.3*<br>529.6* | -                          | -<br>529.1               | 517.7<br>518.2<br>529.3  | 517.8<br>518.4<br>529.8 | 517.8<br>518.4<br>529.7 | 517.7<br>518.2<br>529.7 |
| OWC-10<br>OWC-11<br>OWC-12 | -                       | -                   | -                          | 523.3                   | -               | 523.5<br>-<br>-      | -                       | 516.8                | 516.8*<br>-     | 523.4<br>517.1<br>516.7 | 523.0*<br>517.0*<br>516.7* | -<br>516.6                 | -<br>-<br>516.6*         | 522.8<br>516.7<br>516.6  | 523.1                   | 523.4<br>516.7<br>516.8 | 523.2<br>516.5<br>516.7 |
| owc-13<br>owc-14<br>owc-15 | 512.8<br>505.2<br>504.8 | 512.4<br>-<br>504.2 | 512.5*<br>505.9*<br>504.4* | 513.0<br>508.9<br>504.6 | -               | -                    | 513.5<br>509.2<br>504.8 | -                    | -<br>-<br>-     | 513.3<br>509.4<br>505.0 | 513.1<br>509.2<br>505.0    | 513.4*<br>507.5*<br>505.0* | 88                       | 513.3<br>508.9<br>505.0  | 513.5<br>509.4          | 513.6<br>509.3<br>505.7 | 513.3<br>509.2<br>505.6 |

Water levels measured by WCC personnel using Soil Test electronic water level indicator.

<sup>\*</sup> The well was balled within twenty-four hours prior to measuring this water level and may not have fully recovered to static level.

TABLE 6
SLUG TEST RESULTS \*

| Well   | Depth of<br>Screened<br>Interval,ft | Coefficient<br>of<br>Permeability<br>ft/day | Coefficient<br>of<br>Permeability<br>cm/sec |   |
|--------|-------------------------------------|---|---|---|
| owc-6  | 8 - 25                              | 1   | $5 \times 10^{-4}$                          | ħ |
| OWC-7  | 7 - 17                              | 0.3   | 1 × 10 <sup>-4</sup>                        |   |
| owc-8  | 18.5 - 27.5                         | 0.1   | 3 × 10 <sup>-5</sup>                        |   |
| OWC-9  | 12 - 32                             | 0.2   | 7 × 10 <sup>-5</sup>                        |   |
| OWC-15 | 10 - 20                             | 3   | 1 x 10 <sup>-3</sup>                        |   |
|        |                                     | 4,6   |   |   |

 $<sup>\</sup>star$  Methodology presented by Bower and Rice, 1976

TABLE 7

ARSENIC IN SOIL

Vertical distribution of arsenic in soil samples (parts per million) $^{\star}$ 

| B-219                            | Arsenic                                 |
|----------------------------------|---|
| Sample Depth                     | Concentration                           |
| (ft)                             | ug/g                                    |
| 2 - 3.5                          | 480                                     |
| 4 - 5.5                          | 160                                     |
| 6 - 7.5                          | 31                                      |
| 10 - 11.5                        | 3.6                                     |
| 15 - 16.5                        | 3.3                                     |
| 20 - 21.5                        | 5.5                                     |
| B-203                            | Arsenic                                 |
| Sample Depth                     | Concentration                           |
| (ft)                             | ug/g                                    |
| 5 - 6.5                          | 4.9                                     |
| 10 - 11.5                        | 4.1                                     |
| OWC-10 Sample Depth (ft) 4 - 5.5 | Arsenic<br>Concentration<br>ug/g<br>5.5 |
| OWC-11<br>Sample Depth<br>(ft)   | Arsenic<br>Concentration<br>ug/g<br>570 |

<sup>\*</sup> Samples analyzed for total arsenic in accordance with procedures published in the <u>Federal Register</u>, Vol. 44, No. 233, December 23, 1979.

### TABLE 8

### Parameters Proposed for Analysis of Samples

```
Organochlorine Pesticides
  DDF
                          Toxaphene
  DDT
                          Lindane
  Endrin
                          Kelthane (not analyzed)
  Dieldrin
                          DDD (TDE)
  Aldrin
                          Captan
  Mirex
                          Methoxychlor
  Heptachlor
                          PCB's
  Chlordane
                          Difolatan
  Chlorobenzilate
Organophosphorus Pesticides
  Thosdrin (Mevinphos)
                          Parathion
  Diazinon
                          Trithion (not analyzed)
  Guthion
                          Malathion
Phenoxyacid Herbicides
  2,4-D
  2,4,5-T
Miscellaneous Pesticides (not analyzed)
  Rotenone
  Amitrole
  Sevin
Heavy Metals
  Arsenic
  Copper
  Zinc
  Cadmium
Total Organic Carbon
Standard Water Chemistry Analyses
```

Note: pH, salinity, conductivity and temperature are determined in the field when the water samples are obtained.

TABLE 9

COMPARISON OF SELECTED PESTICIDE CONSTITUENTS
IN SOIL AND GROUNDWATER FROM OWC-10

### Analyses from OWC-10

| Constituent     | Concentration In Soil* (4 to 5.5 ft) ug/g(ppm) | Concentration<br>In Groundwater<br>mg/l |
|-----------------|--|---|
| Aldrin          | 11.9   | .0121                                   |
| Chlordane       | ND(4.0)  | ND(.001)                                |
| 4,4-DDD         | 22.1   | ND(.0002)                               |
| 4,4-DDE         | 7.37   | ND(.0002)                               |
| 4,4-DDT         | 44.2   | ND(.0003)                               |
| Dieldrin        | 1.99   | ND(.0002)                               |
| Endrin          | 1.89   | ND(.0004)                               |
| Heptachlor      | 8.04   | .00858                                  |
| Toxaphene       | ND(10.0)                                       | ND(.01)                                 |
| PCB             | ND(10.0)                                       | ND(.01)                                 |
| Lindane         | 2.72   | .0298                                   |
| Methoxychlor    | ND(4.0)  | ND(.0008)                               |
| Mirex           | ND(4.0)  | ND(.0005)                               |
| Captan          | ND(4.0)  | ND(.0002)                               |
| Difolatan       | ND(4.0)  | ND(.02)                                 |
| Chlorobenzilate | ND(4.0)  | ND(.0003)                               |
| Arsenic         | 5.5  | .006                                    |

Soil samples were analyzed on a total extraction basis. The organic analyses of soil and water samples were performed in accordance with procedures published in the <u>Federal Register</u>, Vol. 38, No. 75, Pt. II. Groundwater samples were filtered through a glass fiber filter of 1 micron pore size prior to analysis. Analysis for total arsenic was performed in accordance with procedures published in the <u>Federal Register</u>, Vol. 44, No. 233, December 23, 1979.

<sup>\*</sup>The soil sample was obtained approximately I foot above the static groundwater level.

TABLE 10

## COMPARISON OF SELECTED PESTICIDE CONSTITUENTS IN SOIL AND GROUNDWATER FROM OWC-11

### Analyses from OWC-11

| Constituent                | Concentration In Soil* (1.0 to 2.5 ft) ug/g(ppm) | Concentration<br>in Groundwater<br>mg/l |
|----------------------------|--|---|
| Aldrin                     | 100  | ND(.00012)                              |
| Chlordane                  | ND(4.0)  | ND(.001)                                |
| 4,4-DDD                    | 351  | .00146                                  |
| 4,4-DDE                    | 126  | ND(.0002)                               |
| 4,4-DDT                    | 703  | .00146                                  |
| Dieldrin                   | 113  | .0173                                   |
| Endrin                     | 95.2   | .00055                                  |
| Heptachlor                 | 17.8   | ND(.0001)                               |
| Toxaphene                  | ND(10.0)   | ND(.01)                                 |
| PCB                        | ND(10.0)   | ND(.01)                                 |
| Lindane                    | 2.78   | .106                                    |
| Methoxychlor               | ND(4.0)  | ND(.0008)                               |
| Mirex                      | ND(4.0)  | ND(.0005)                               |
| Captan                     | ND(4.0)  | ND(.0002)                               |
| Difolatan                  | ND(4.0)  | ND(.02)                                 |
| Chlorobenzilate<br>Arsenic | ND(4.0)<br>570                                   | ND(.0003)                               |

Soil samples were analyzed on a total extraction basis. The organic analyses of soil and water samples were performed in accordance with procedures published in the Federal Register, Vol. 38, No. 75, Pt. II. Groundwater samples were filtered through a glass fiber filter of 1 micron pore size prior to analysis. Analysis for total arsenic was performed in accordance with procedures published in the Federal Register, Vol. 44, No. 233, December 23, 1979.

<sup>\*</sup> The soil sample was obtained approximately 3 feet above the static groundwater level.

### TABLE 11

### Extraction Procedure Toxicity Analyses

Analyses were performed according to "Methods for Analysis of Water and Wastes", EPA-600/4-79-020, using a Perkin-Elmer 503 Atomic Absorption Spectrophotometer equipped with a flame and graphite furnace. Analyses were performed by Bruce Fast and Robert Rickard.

Organic compounds were analyzed, according to "Methods for Benzidine, Chlorinated Organic Compounds, Pentachlorophenol and Pesticides in Water and Wastewater", U.S.E.P.A., September 1978, on a Hewlett-Packard 5710 gas chromatograph equipped with a Ni63 electron capture detection on a 1.5% SP-2250/1.95% SP-2401 Supelcoport 100/120 column at 185°C with a carrier gas flow of 60 ml/min. Analyses were performed by Clifford Baker.

|              |                               |                       |                                      | Analyses Results                     |                               |
|--------------|-------------------------------|-----------------------|--------------------------------------|--------------------------------------|-------------------------------|
|              |                               |                       | Soil beneath<br>Pond                 | Sediment from<br>Pond                | Soil from<br>Waste Pile       |
| Analysis     | EPA Hazardous<br>Waste Number | Toxicity Limit (mg/1) | S81-5 B212 7 ft. 3-3,4<br>8103-0213E | S81-5 B212 3 ft. 1-3,4<br>8103-0213E | 581-5 Soil Pile<br>8103-0184E |
| Arsenic      | D004                          | 5.0                   | ND(0.05)                             | 2.8                                  | 0.033                         |
| Barium       | D005                          | 100                   | ND(0.2)                              | ND(1.0)                              | ND(0.2)                       |
| Cadmium      | D006                          | 1.0                   | ND(0.05)                             | ND(.01)                              | ND(0.05)                      |
| Chromium     | D007                          | 5.0                   | ND(0.05)                             | ND(.05)                              | 0.20                          |
| Lead         | D008                          | 5.0                   | ND(0.2)                              | ND(.10)                              | ND(0.2)                       |
| Mercury      | D009                          | 0.20                  | ND(0.001)                            | ND(.0001)                            | ND(0.001)                     |
| Selenium     | D010                          | 1.0                   | ND(0.01)                             | ND(.01)                              | ND(0.01)                      |
| Silver       | D011                          | 5.0                   | ND(0.05)                             | ND(.05)                              | ND(0.05)                      |
| Endrin       | D012                          | 0.02                  | ND(0.005)                            | ND(.005)                             | ND(0.005)                     |
| Lindane      | D013                          | 0.4                   | ND(0.0012)                           | ND(.001)                             | 0.021                         |
| Methoxychlor | D014                          | 10.0                  | ND(0.05)                             | ND(.05)                              | ND(0.05)                      |
| Toxaphene    | D015                          | 0.5                   | ND(0.05)                             | ND(.05)                              | ND(0.05)                      |
| 2,4-D        | D016                          | 10.0                  | ND(0.01)                             | NU(.01)                              | ND(0.01)                      |
| 2,4,5-TP     | D017                          | 1.0                   | ND(0.005)                            | .019                                 | ND(0.005)                     |

ND denotes none detected. The detection limit of the method is shown in parentheses.

WILSON LABORATORIES

Robert L. Meyer Chief Chemist EP TOXICITY TEST RESULTS FOR SOIL/ROCK WASTE PILE
AND NATURAL SOIL APPROXIMATELY 4 FEET BELOW THE BOTTOM OF THE
STORM WATER RETENTION POND

File No. 81-9521

Lab No. 8103-0213E & 8103-0184E

Date: 13 March 1981

TABLE 12 GROUNDWATER QUALITY ANALYSES - ORTHO-CHEVRON, MARYLAND HEIGHTS, MISSOURI

| Organic Constituents                          | <u> 0wc-1</u>    | <u>owc-3</u>     | <u>0wc-4</u>       | <u>0wc-5</u>     | <u>owc-6</u>       | OWC-7              | s, ug/1 (ppt<br>0WC-8 | <u>owc-9</u>         | 0WC-10             | OWC-11               | OWC-12            | 0WC-13              | OWC-14          | 0wc-15          | Detection<br>Limit | EPA Drinking<br>Water Standards* | Missourl<br>Groundwater<br>Recharge Standards* |
|---|------------------|------------------|--------------------|------------------|--------------------|--------------------|-----------------------|----------------------|--------------------|----------------------|-------------------|---------------------|-----------------|-----------------|--------------------|----------------------------------|--|
| 2,4-D<br>2,4,5-T<br>,4,4-DDD                  | 1.8<br>ND<br>ND  | ND<br>. 1<br>. D | 47<br>1.9<br>ND    | ND<br>ND<br>ND   | 1.1<br>ND<br>2.53  | 2.6<br>.2<br>ND    | 87.8<br>9.7<br>ND     | ND<br>ND<br>1.08     | 30.9<br>15.7<br>ND | 2300<br>18.8<br>1.46 | ND<br>1.2<br>ND   | 1.3<br>.8<br>.3     | ND<br>ND<br>.5  | ND<br>ND<br>ND  | 1.0<br>.1<br>.2    | 100                              | <br><br>                                       |
| 4,4-DDE<br>4,4-DDT<br>√ Aldrin                | ND<br>ND<br>.12  | ND<br>ND<br>ND   | ND<br>ND<br>ND     | ND<br>ND<br>ND   | ND<br>.96<br>6.94  | ND<br>ND<br>63.3   | ND<br>ND<br>4.59      | . 22<br>. 53<br>. 26 | ND<br>ND<br>12.1   | ND<br>1.46<br>ND     | ND<br>4.8<br>17.7 | . 35<br>ND<br>16. 3 | ND<br>ND<br>.88 | ND<br>ND<br>ND  | .2<br>.3<br>.12    | <br><br>                         |  |
| ∜Diazinon<br>√Dieldrin<br>Endrin              | ND<br>ND<br>ND   | 1.7<br>ND<br>ND  | 1.6<br>- ND<br>ND  | ND<br>ND<br>ND   | 27.3<br>3.89<br>ND | 427<br>ND<br>ND    | 37.8<br>1.45<br>ND    | ND<br>. 55<br>ND     | 377<br>ND<br>ND    | 11.1<br>17.3<br>.55  | 4.3<br>7.8<br>4.3 | ND<br>1.06<br>ND    | .69<br>ND       | ND<br>.21<br>ND | .5<br>.2<br>.4     | .2                               | <br>   |
| √Ethyl-Parathion<br>, Heptachlor<br>./Lindane | ND<br>ND<br>. 26 | ND<br>ND<br>1.07 | ND<br>1.76<br>1.25 | ND<br>ND<br>. 29 | .8<br>4.52<br>43.2 | 12.9<br>ND<br>1880 | 2.5<br>ND<br>184      | ND<br>ND<br>.82      | ND<br>8.58<br>29.8 | ND<br>ND<br>106      | 53.2<br>ND<br>417 | ND<br>ND<br>2300    | ND<br>ND<br>.93 | ND<br>ND<br>.23 | .5<br>.1<br>.1     | <br><br>4.0                      |  |
| Malathion<br>Methyl-Parathion<br>Mirex        | ND<br>ND<br>ND   | ND<br>ND<br>ND   | ND<br>ND<br>3.07   | яр<br>3.8<br>ND  | ND<br>2.2<br>ND    | 100<br>6.1<br>ND   | ND<br>1.6<br>ND       | ND<br>ND<br>ND       | 6.6<br>26.7<br>ND  | 5.7<br>2.5<br>ND     | 223<br>10.9<br>ND | . ND<br>ND<br>ND    | ND<br>ND<br>ND  | ND<br>ND<br>ND  | 2.0<br>2.0<br>.5   | <br><br>                         | <br>   |
| PCB<br>Phosdrin                               | ND<br>ND         | ND<br>ND         | ND<br>ND           | ND<br>ND         | 1600               | ND<br>7.9          | ND<br>ND              | ND<br>ND             | ND<br>ND           | ND<br>ND             | ND<br>ND          | ND<br>ND            | ND<br>ND        | ND<br>ND        | 10.0               | ·                                | <br>   |

The following organic pesticide compounds were analyzed for and were not detected in any of the groundwater samples:

| Constituent     | Detection Limit, ug/1 (ppb) |  |  |  |  |  |
|-----------------|-----------------------------|--|--|--|--|--|
| Captan          | . 20                        |  |  |  |  |  |
| Chlordane       | 1.0                         |  |  |  |  |  |
| Chlorobenzilate | . 30                        |  |  |  |  |  |
| Difolatan       | 20.0                        |  |  |  |  |  |
| Guthion         | 100.0                       |  |  |  |  |  |
| Methoxychlor    | .8                          |  |  |  |  |  |
| Toxaphene       | 10.0                        |  |  |  |  |  |

The samples were not analyzed for: Kelthane, Trithion, Rotenone, Amitrole, and Sevin.

Groundwater samples for organic analyses were filtered through 1 micron pore size glass fiber filters prior to analysis. Samples for organic analyses were analyzed in accordance with procedures published in the <a href="Federal Register">Federal Register</a>, Volume 38, No. 75, Part II.

\*The EPA Drinking Water Standards and Missouri Groundwater Recharge Standards are shown for comparison purposes only.

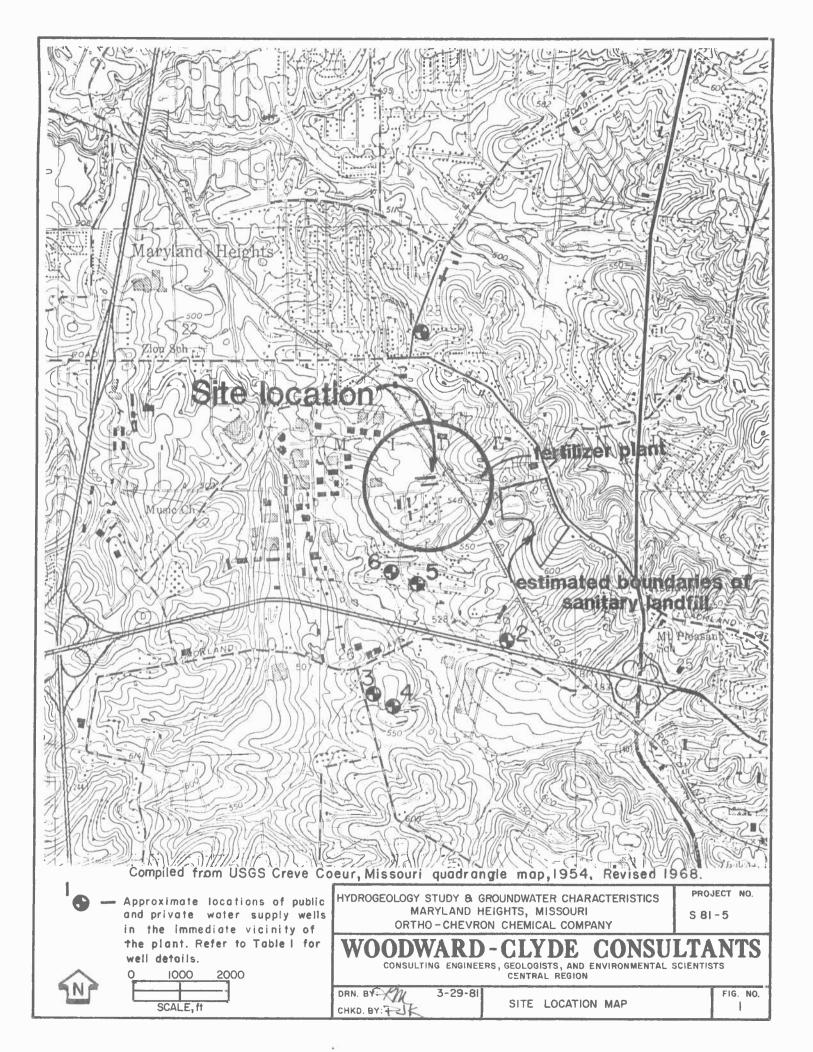
thousand should be byon, 0, T, endring & BHC

TABLE 12
GROUNDWATER QUALITY ANALYSES - ORTHO-CHEVRON, MARYLAND HEIGHTS, MISSOURI

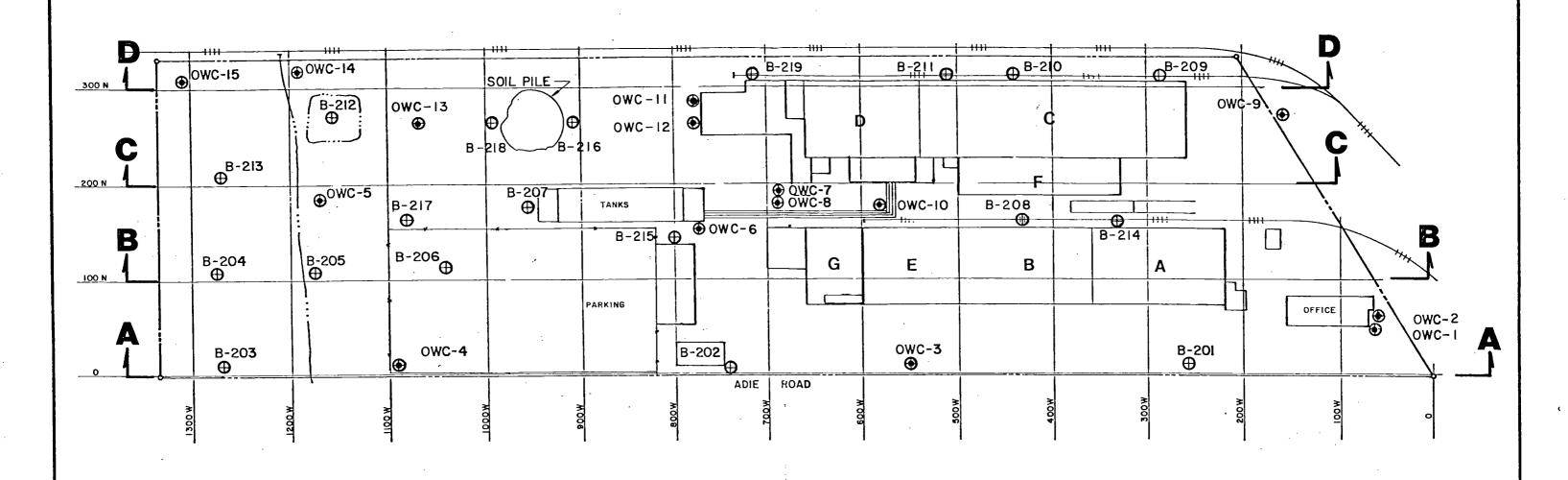
|   | Concentrations, mg/1 (ppm) |                        |                          |                        |                           |                          |                        |                       |                          |                          |                         |                          |                       |                        | Detection     | EPA Drinking                  | Missour!<br>Groundwater |
|---|----------------------------|------------------------|--------------------------|------------------------|---------------------------|--------------------------|------------------------|-----------------------|--------------------------|--------------------------|-------------------------|--------------------------|-----------------------|------------------------|---------------|-------------------------------|-------------------------|
| Inorganic Constituents                              | OWC-1                      | OWC-3                  | OWC-4                    | OWC-5                  | OMC-6                     | owc-7                    | OWC-8                  | 0WC-9                 | OWC - 10                 | OWC-11                   | 0WC-12                  | 0WC-13                   | OWC-14                | OWC-15                 | Limit         | Water Standards*              | Recharge Standards*     |
| Arsenic<br>Cadmium<br>Copper                        | .01<br>.0005<br>.0027      | .024<br>.0006<br>.0069 | ND<br>.0021<br>.0023     | .003<br>.001<br>.012   | .056<br>.0021<br>.0018    | .13<br>.012<br>.096      | .005<br>.001<br>.0028  | .005<br>ND<br>.0015   | .006<br>.010<br>.063     | .11<br>.001<br>.0034     | .001<br>.0055           | ND<br>.0006<br>.0032     | .008<br>.0018<br>.020 | ND<br>ND<br>.002       | .001          | .05<br>.01<br>1.0             | .05<br>.01<br>.02       |
| Zinc<br>pH<br>Total Dissolved Solids                | .05<br><b>6.3</b><br>788   | .04<br>6.4<br>855      | .048<br>6.3<br>1190      | .07<br>6.5<br>860      | .039<br><b>6.2</b><br>638 | .36<br>6.5<br>1255       | .059<br>6.7<br>907     | .04<br>6.7<br>550     | . 24<br>6 . 3<br>777     | .061<br>7.0<br>876       | .03<br>7.2<br>634       | .05<br>6.6<br>1000       | .08<br>6.8<br>756     | .03<br>6.3<br>273      | -di<br>-<br>- | 5.0<br>6.5 - 8.5<br>500       | 6.5 - 9.0               |
| Chloride<br>Flouride<br>Nitrate (as NO3)<br>Sulfate | 142<br>.22<br>11.5<br>140  | 284<br>.14<br>8.0      | 540<br>.11<br>12.4<br>75 | 46<br>.14<br>0.0<br>95 | 116<br>.19<br>4.0<br>145  | 296<br>.24<br>0.0<br>220 | 120<br>.21<br>.9<br>95 | 7<br>.52<br>6.2<br>35 | 112<br>.20<br>0.0<br>115 | 264<br>.17<br>1.8<br>125 | 20<br>.34<br>1.3<br>125 | 232<br>.14<br>0.0<br>200 | 74<br>.17<br>4.43     | 29<br>-14<br>8.4<br>60 | -             | 250<br>1.4 - 2.4<br>45<br>250 | 2.0<br>45               |

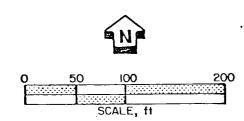
Groundwater samples to be analyzed for heavy metals were filtered through 0.45 micron pore size filter membranes and acid preserved at the time of collection. The groundwater samples analyzed for inorganics were analyzed in accordance with procedures published in the Federal Register, Volume 44, No. 233, December 23, 1979.

\*The EPA Drinking Water Standards and Missouri Groundwater Recharge Standards are shown for comparison purposes only.



Reproduced from the site plan provided by the Ortho-Chevron Chemical Company.





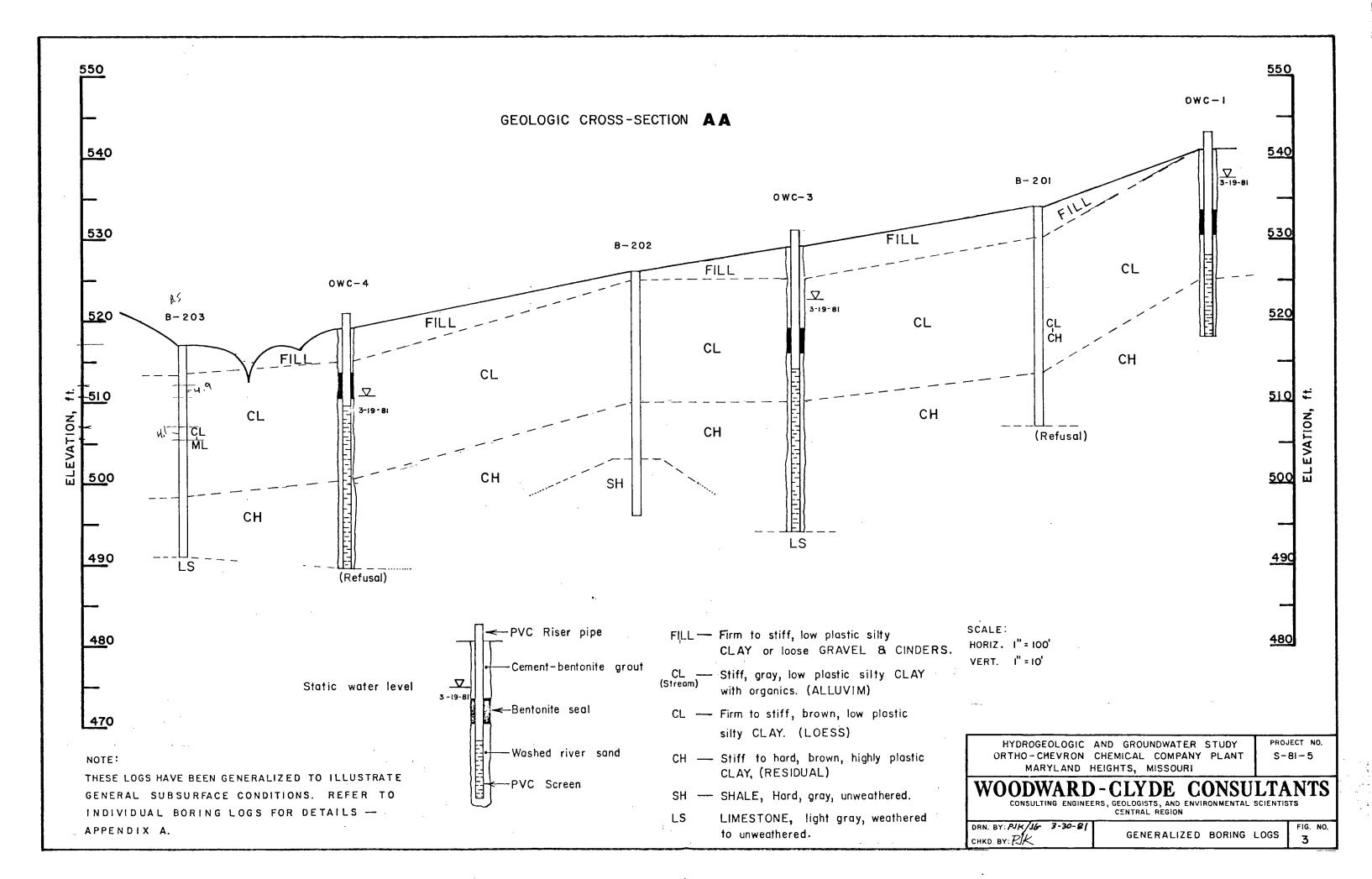
Geologic cross-sections; refer to figures 3 through 6. Exploratory boring location and number Groundwater well location and designation

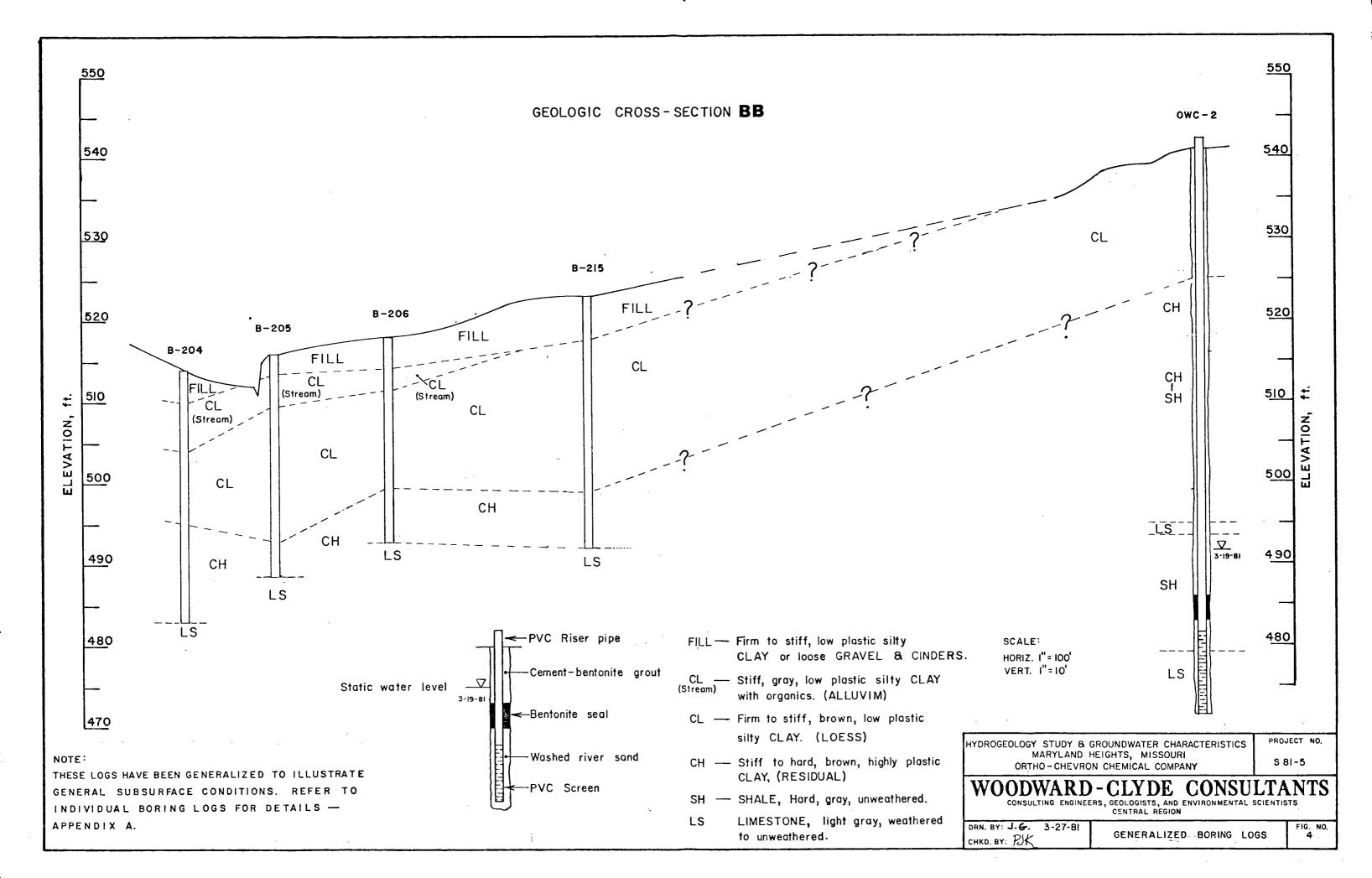
> HYDROGEOLOGY STUDY & GROUNDWATER CHARACTERISTICS MARYLAND HEIGHTS, MISSOURI ORTHO-CHEVRON CHEMICAL COMPANY

PROJECT NO. S 81-5

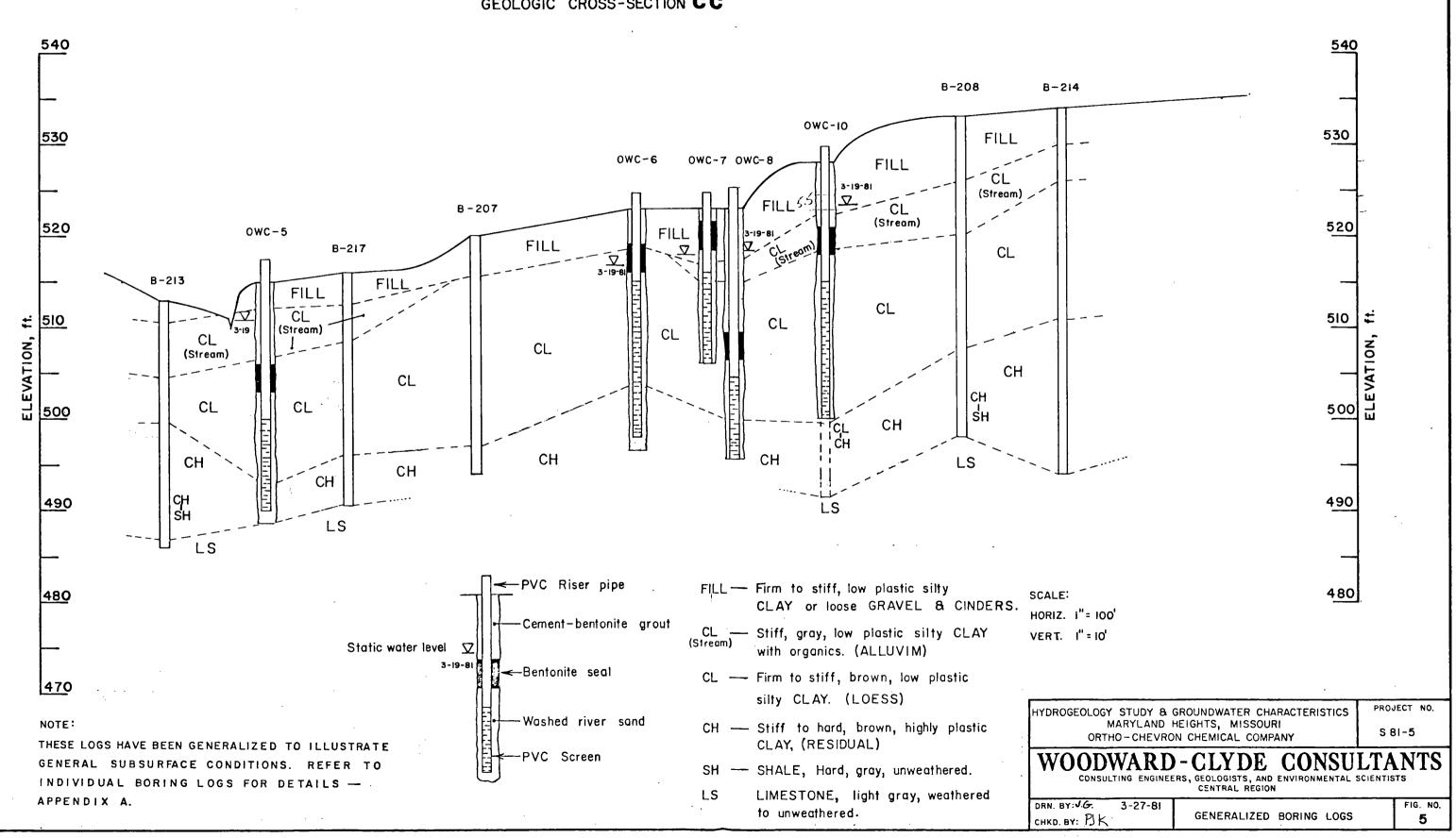
# WOODWARD - CLYDE CONSULTAN CONSULTING ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS CENTRAL REGION

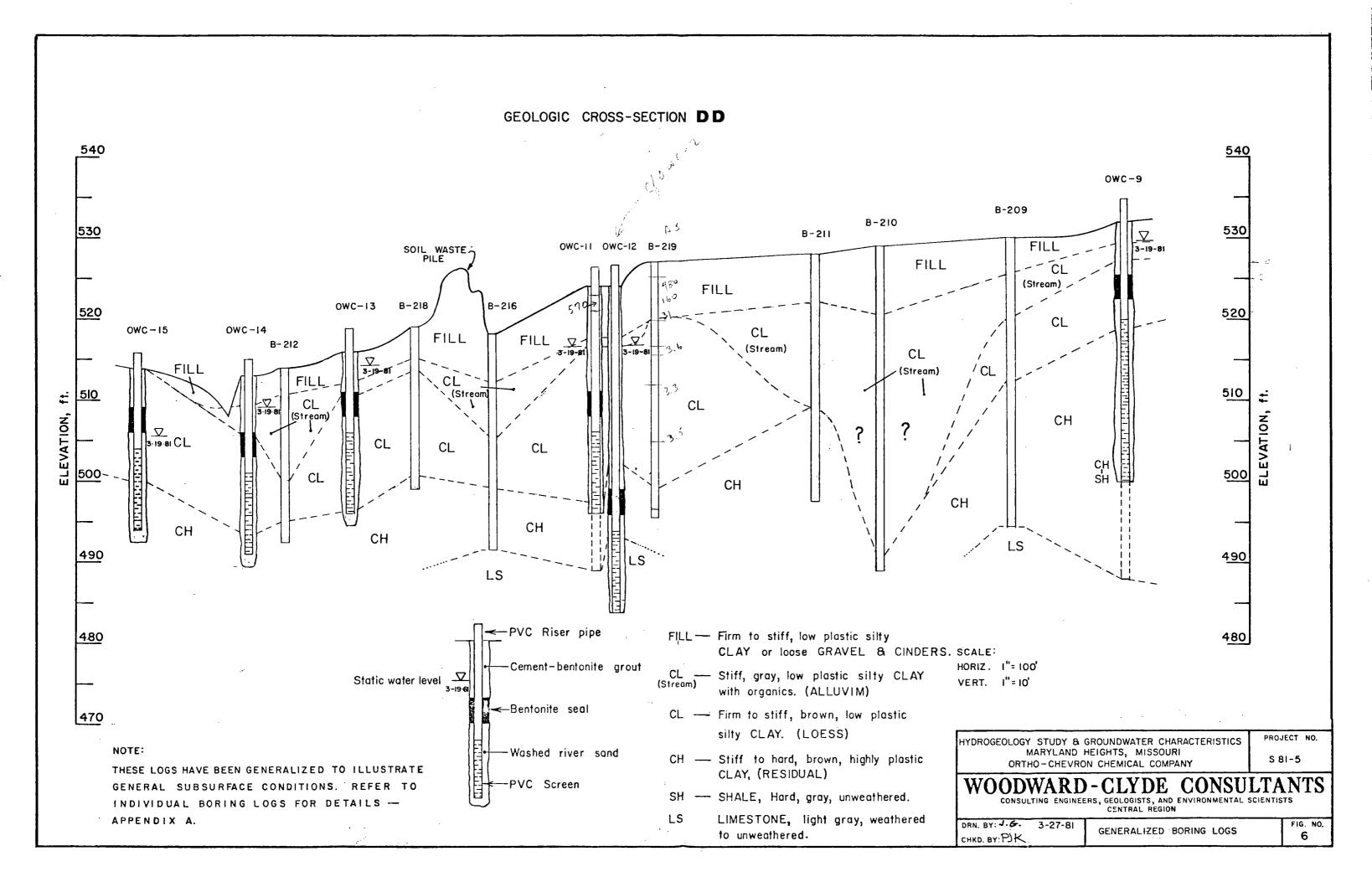
| DRN. BY - KM  | 3-10-81 |             |   | FIG. NO. |
|---------------|---------|-------------|---|----------|
| CHKO. BY: PJK | ·       | SITE PLAN . | 2 |          |

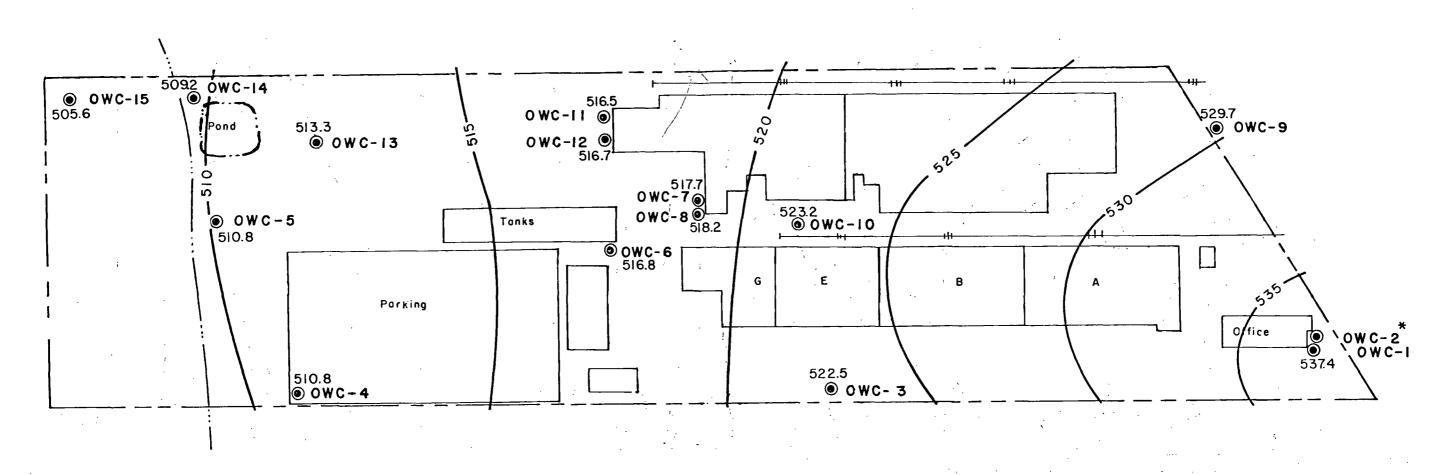


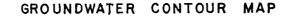


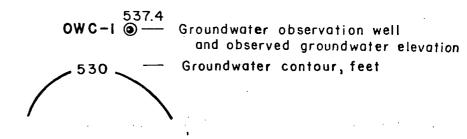
### GEOLOGIC CROSS-SECTION CC











DEPTHS of NESTED WELLS

OWC-I 23

OWC-2 69.5

OWC-7 17

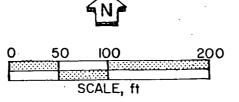
OWC-8 27.5

OWC-11 28

OWC-12 40.3

REMAINING WELLS VARY IN DEPTH FROM 20 to 35 FEET

REFER TO TABLE 2 OR APPENDIX B FOR OBSERVATION WELL DETAILS



Interpreted from water levels observed on 3-19-81

HYDROGEOLOGY & GROUNDWATER STUDY MARYLAND HEIGHTS, MISSOURI ORTHO-CHEVRON CHEMICAL COMPANY

PROJECT NO. S81-5

# -CLYDE CONS

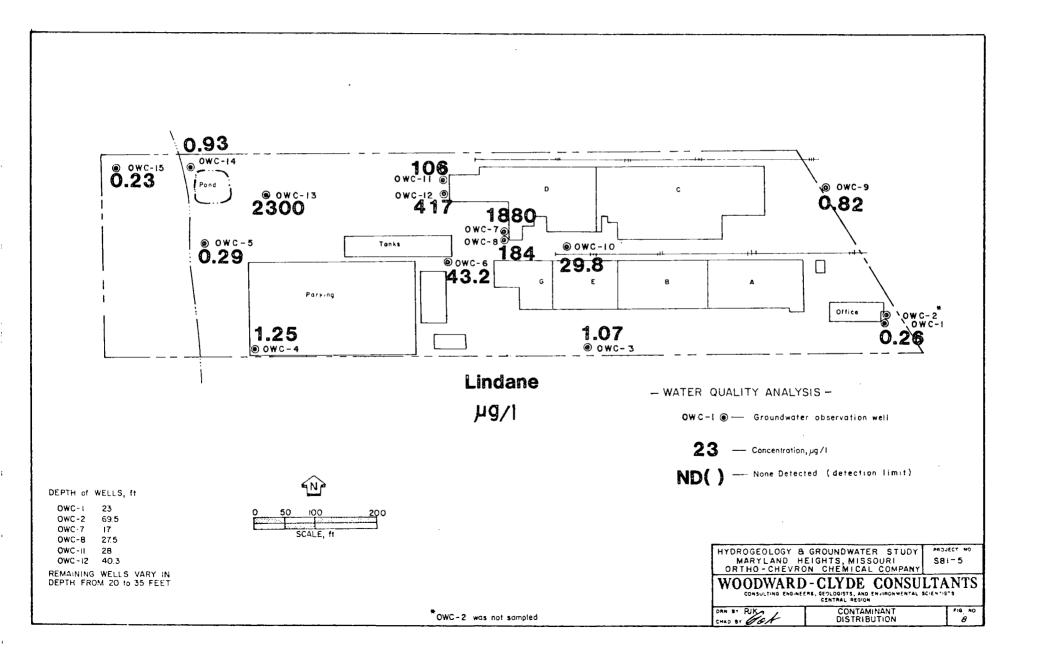
CONSULTING ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS
CENTRAL REGION

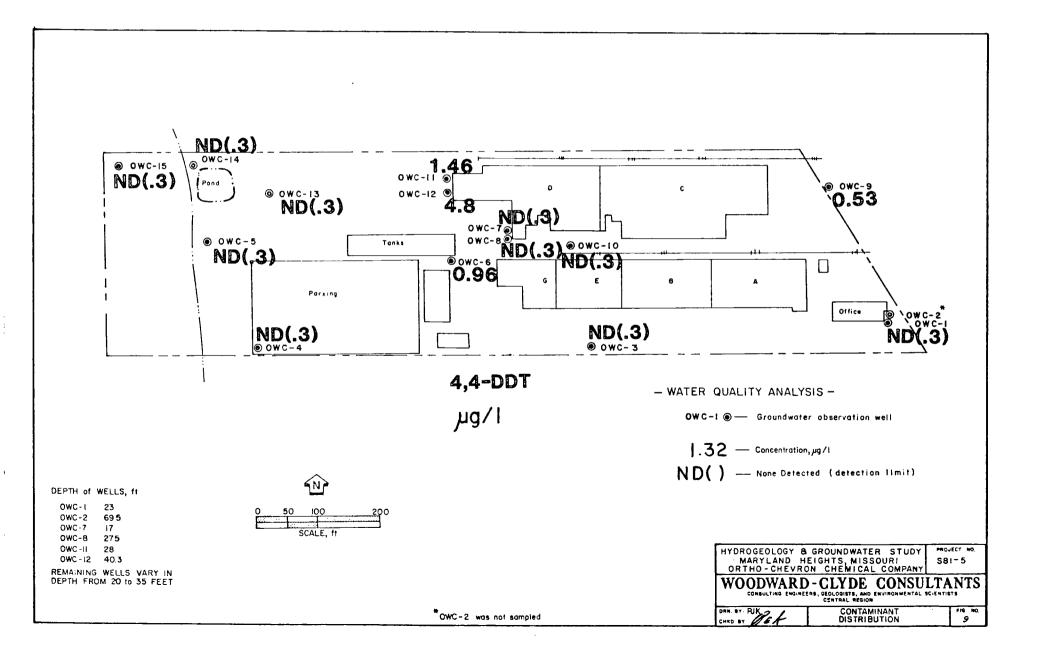
DRN. BY: PJK CHKD. BY: JDC

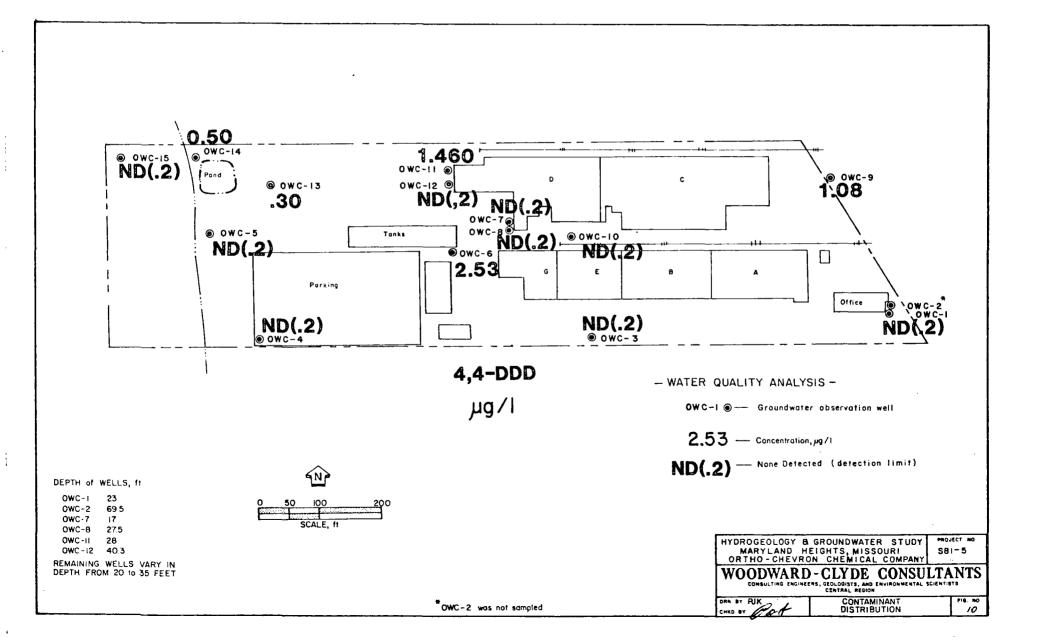
**GROUNDWATER** CONTOUR MAP

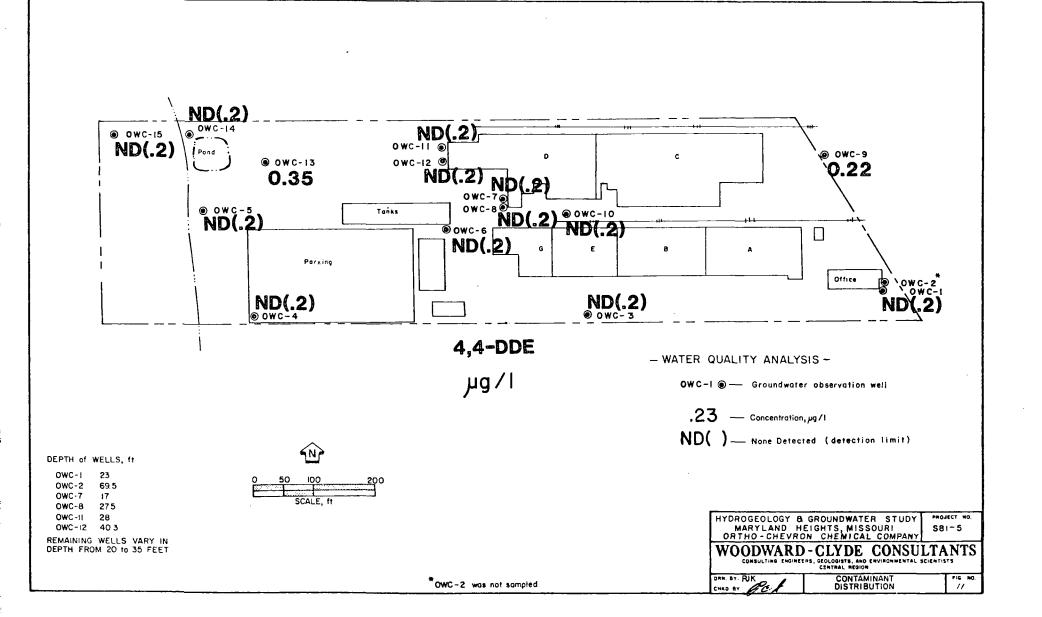
FIG. NO.

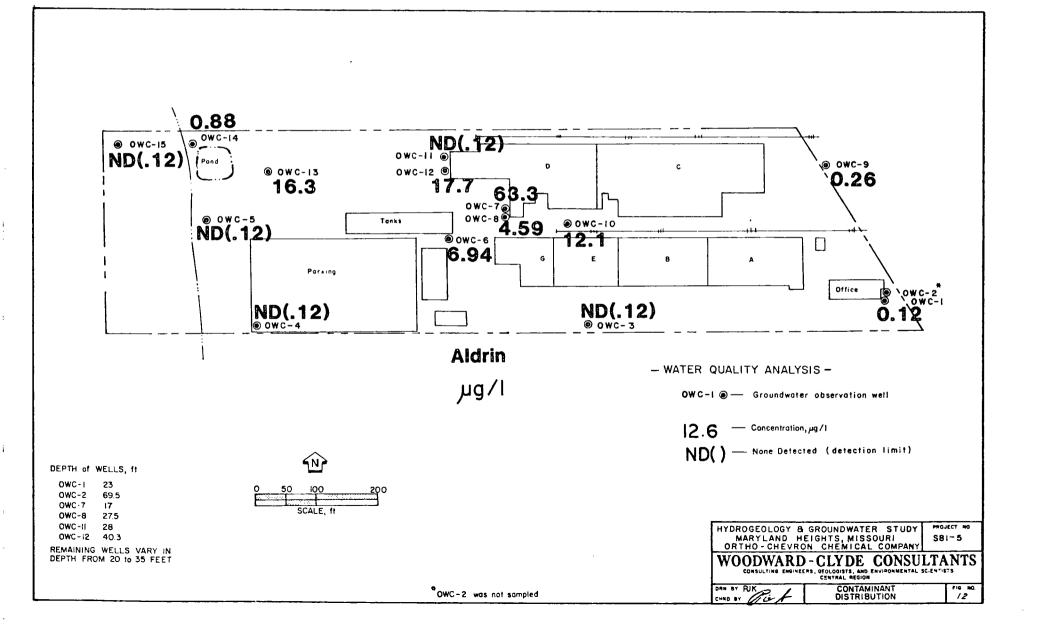
\*OWC-2 was not included

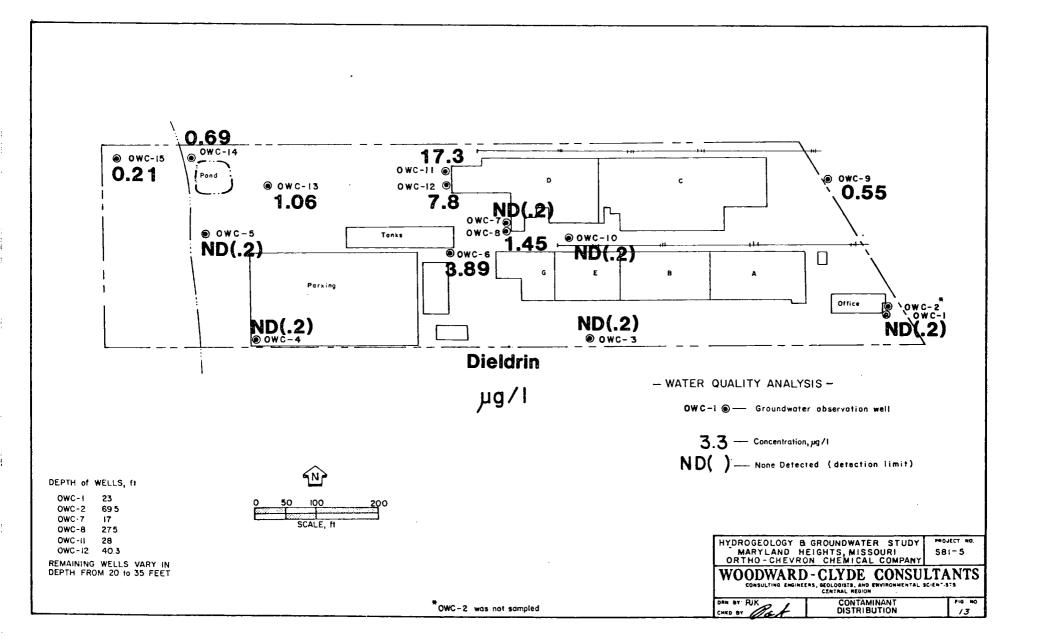


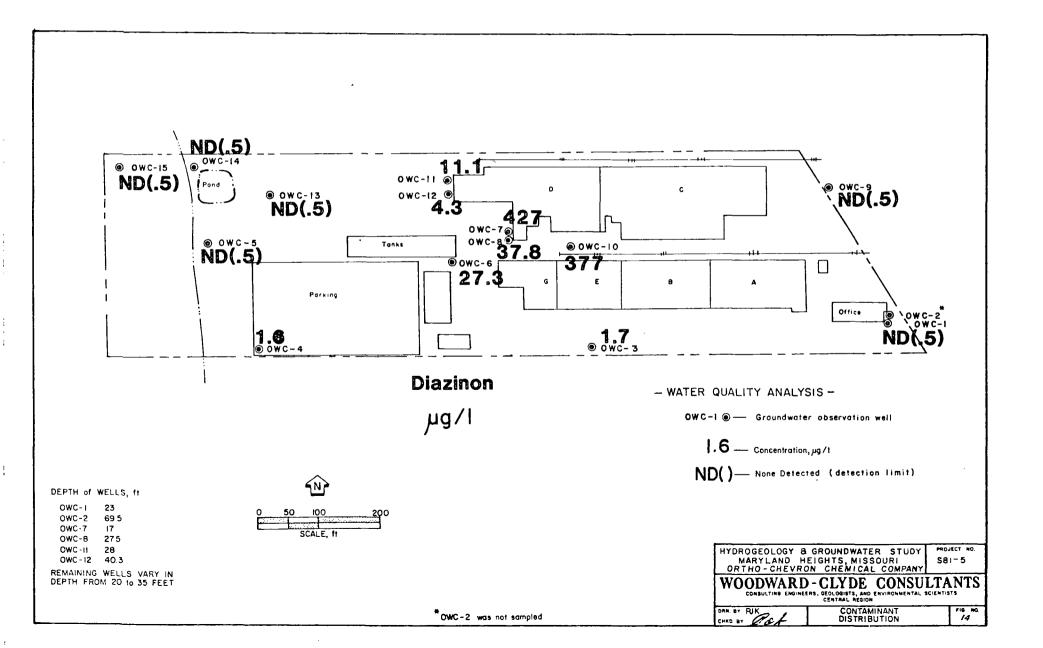


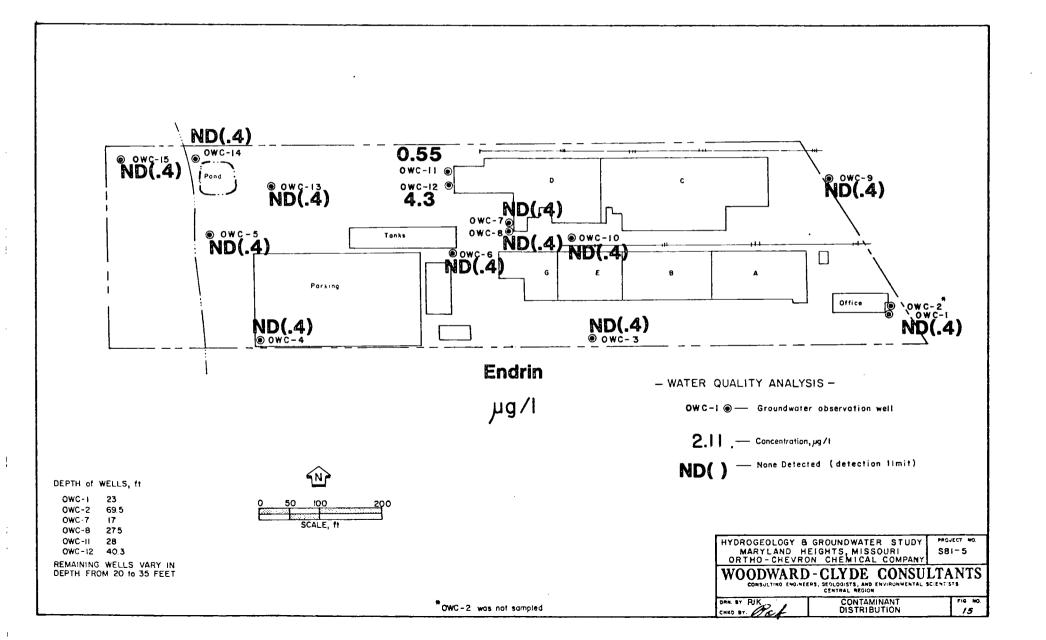


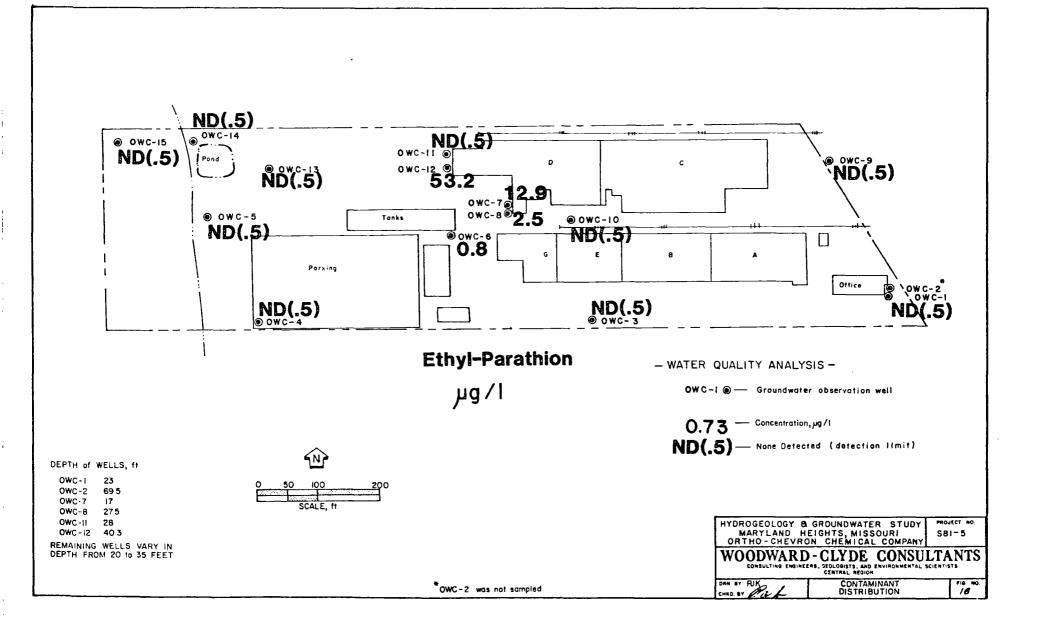


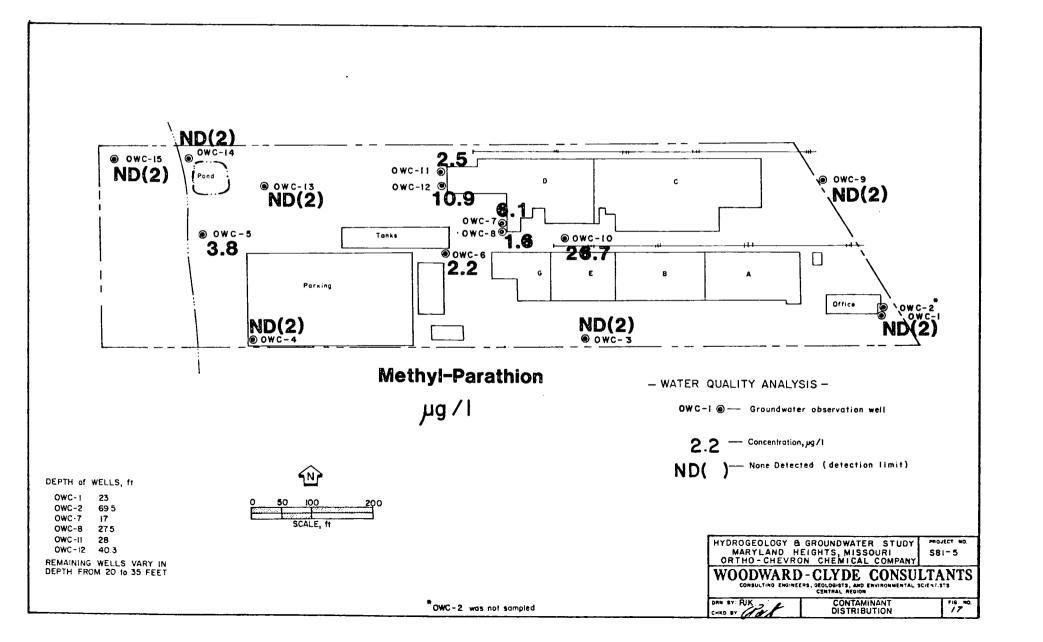


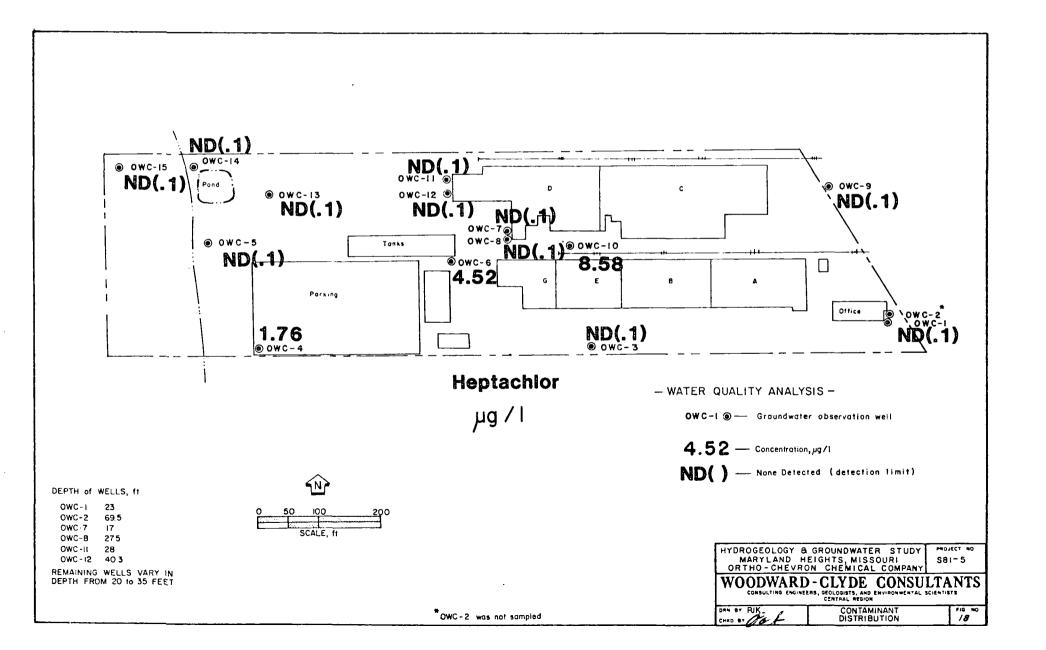


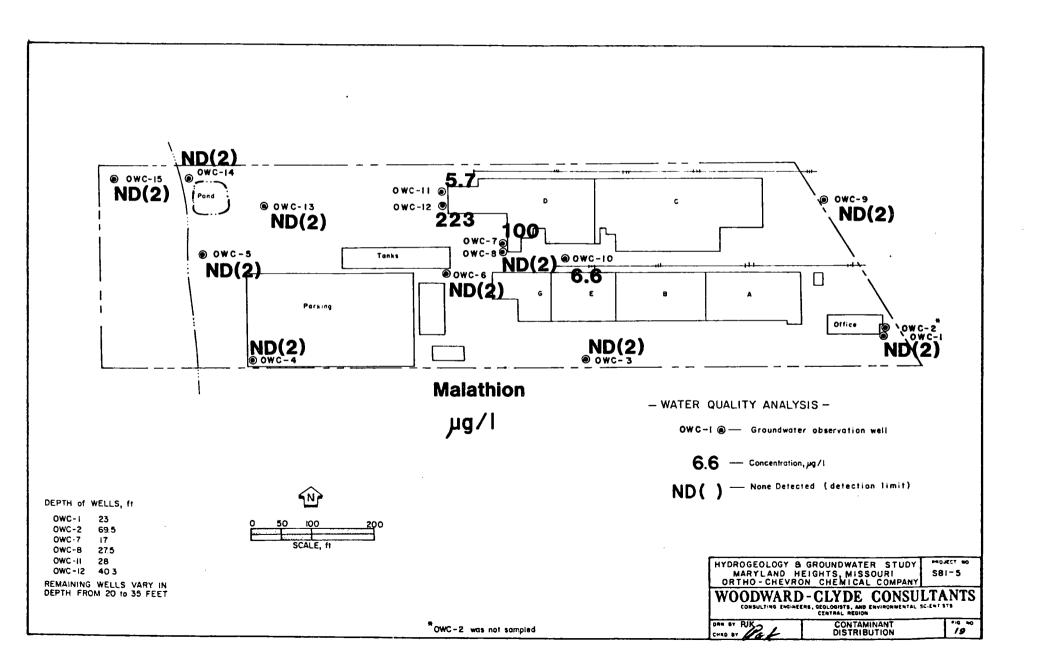


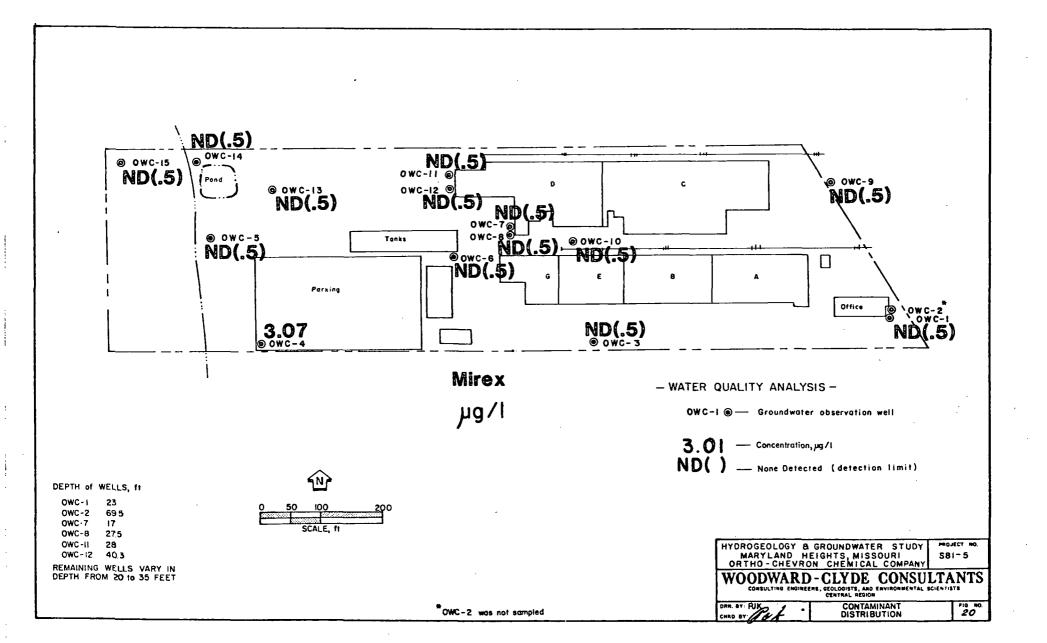


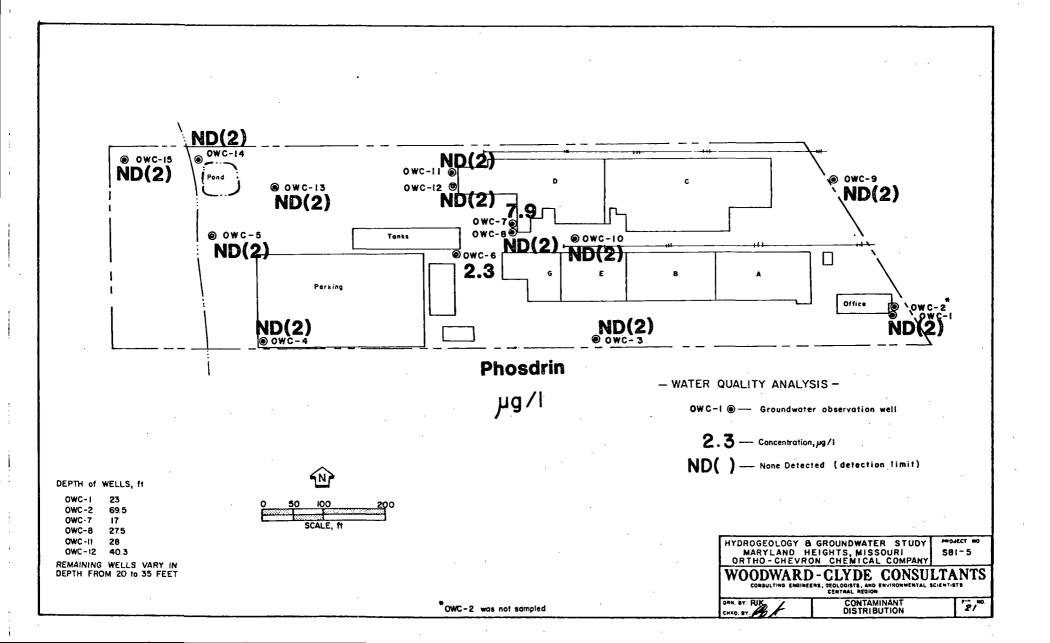


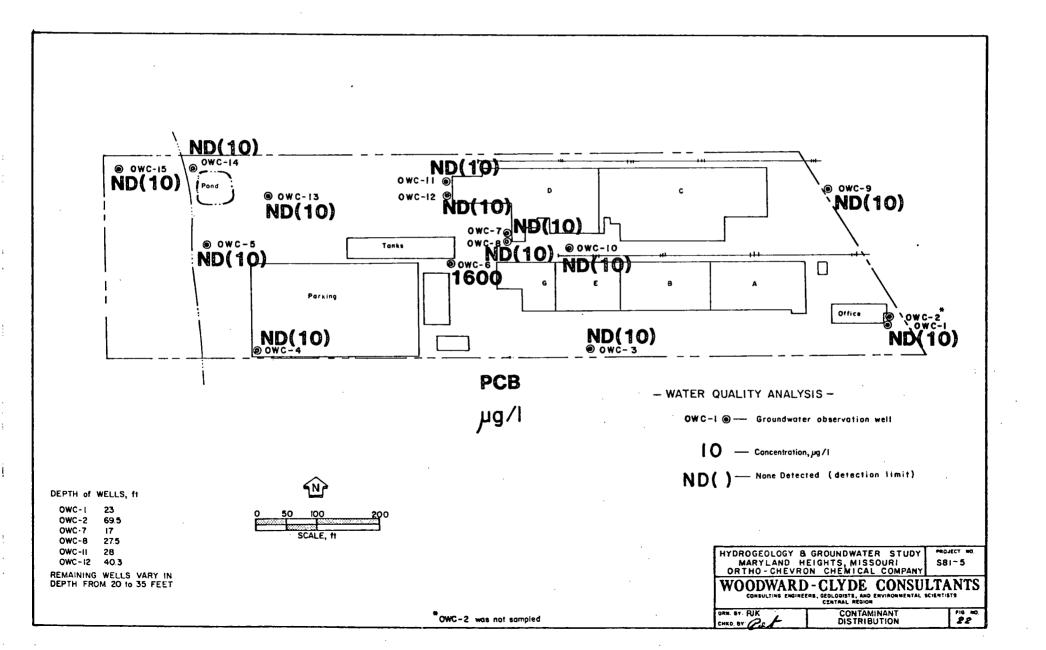


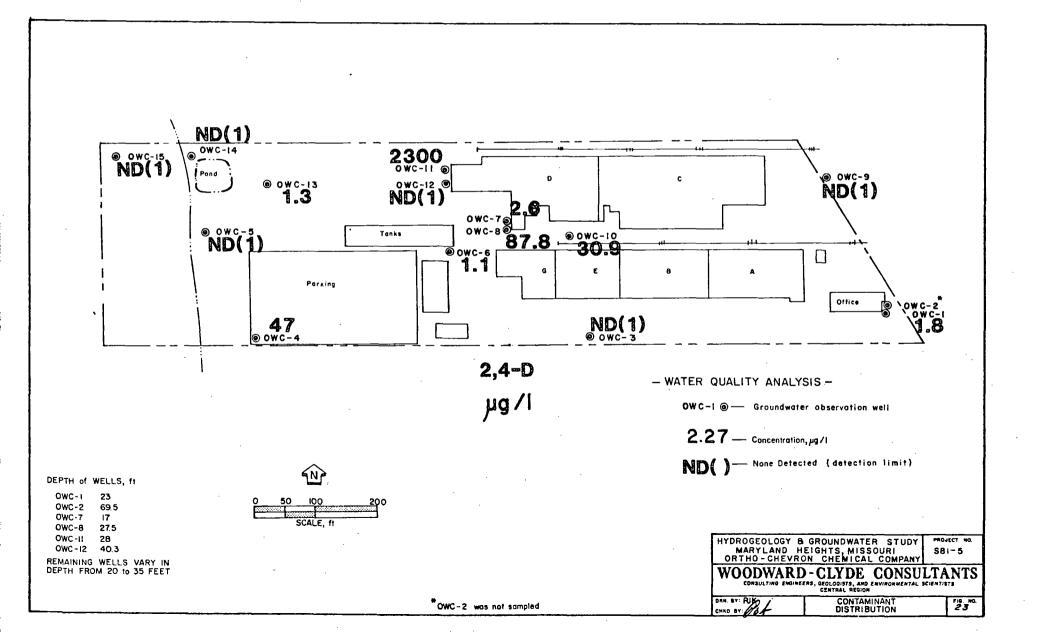


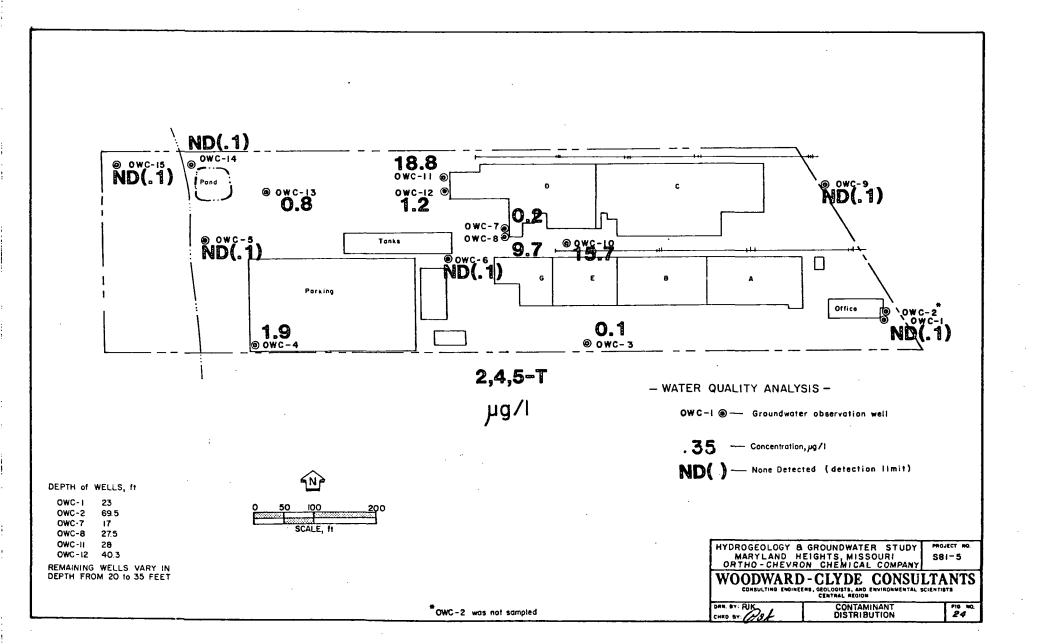


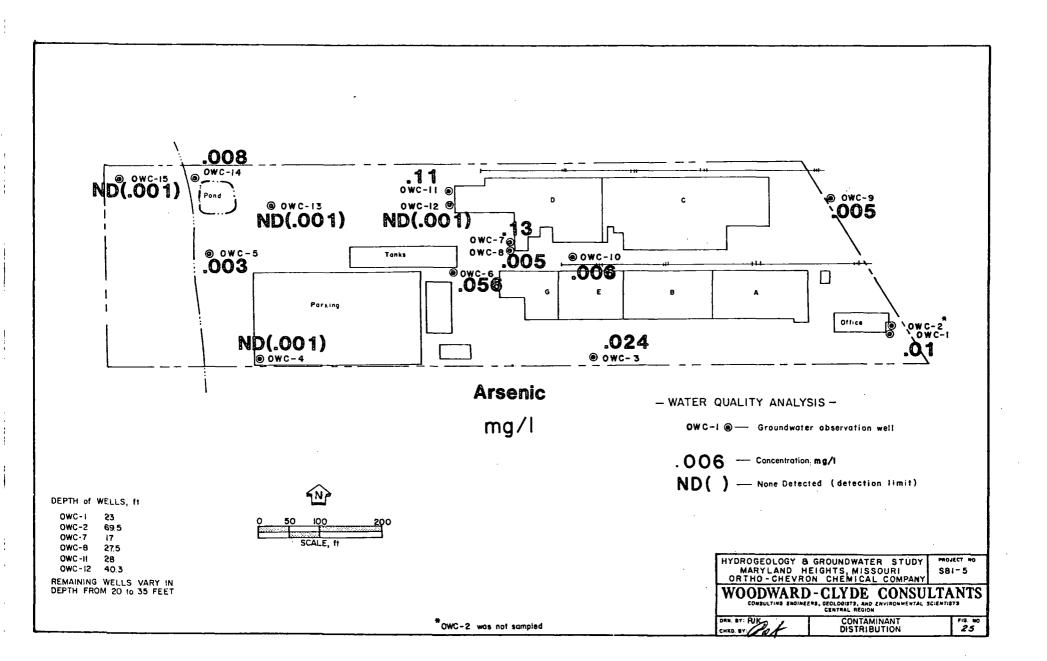


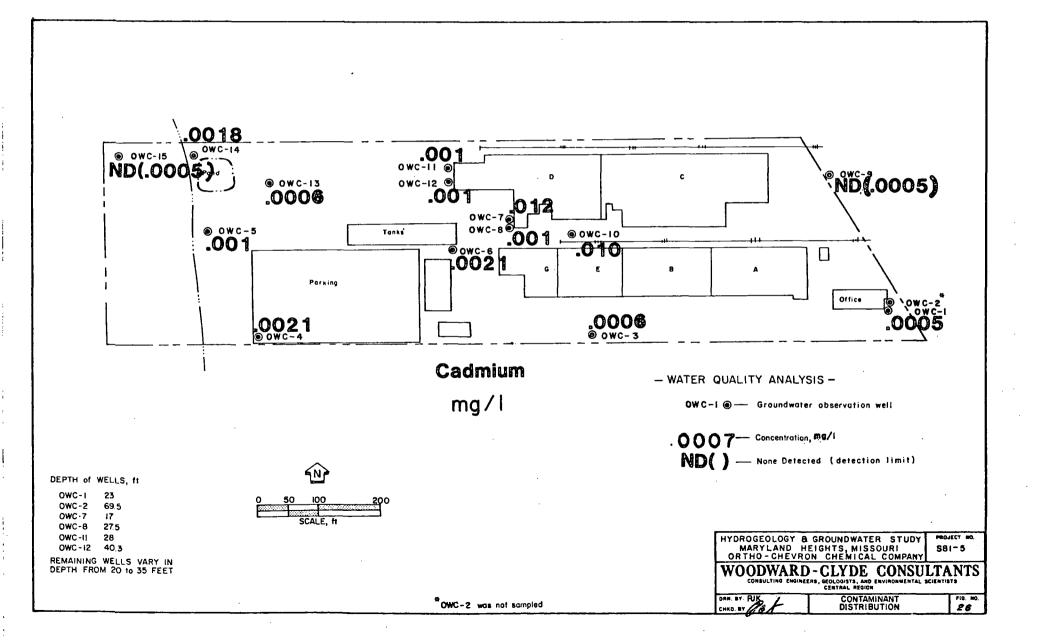


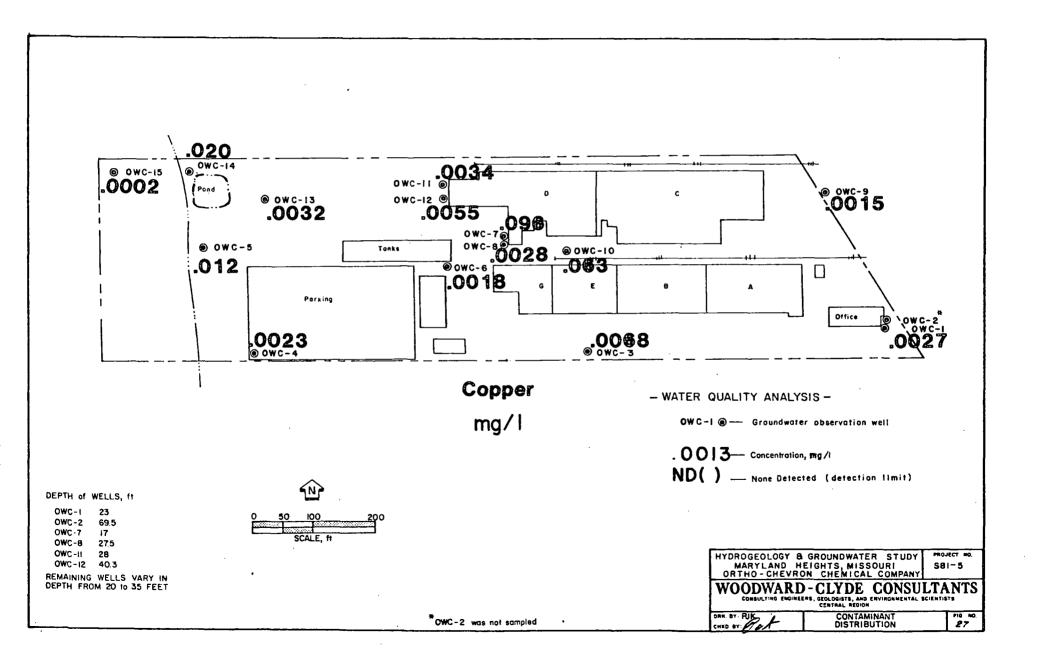


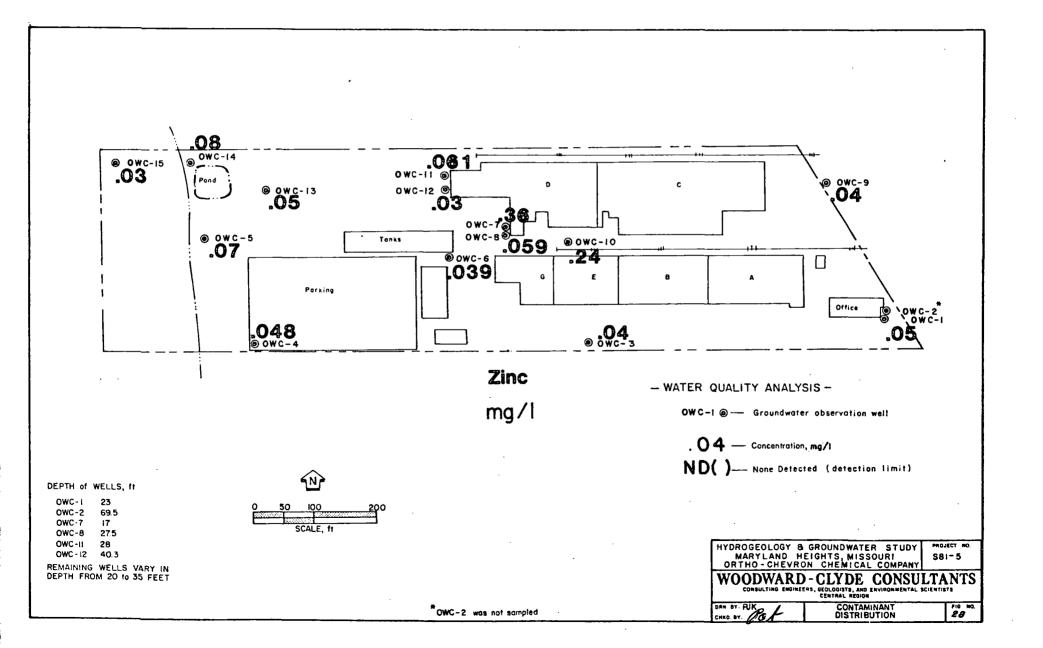


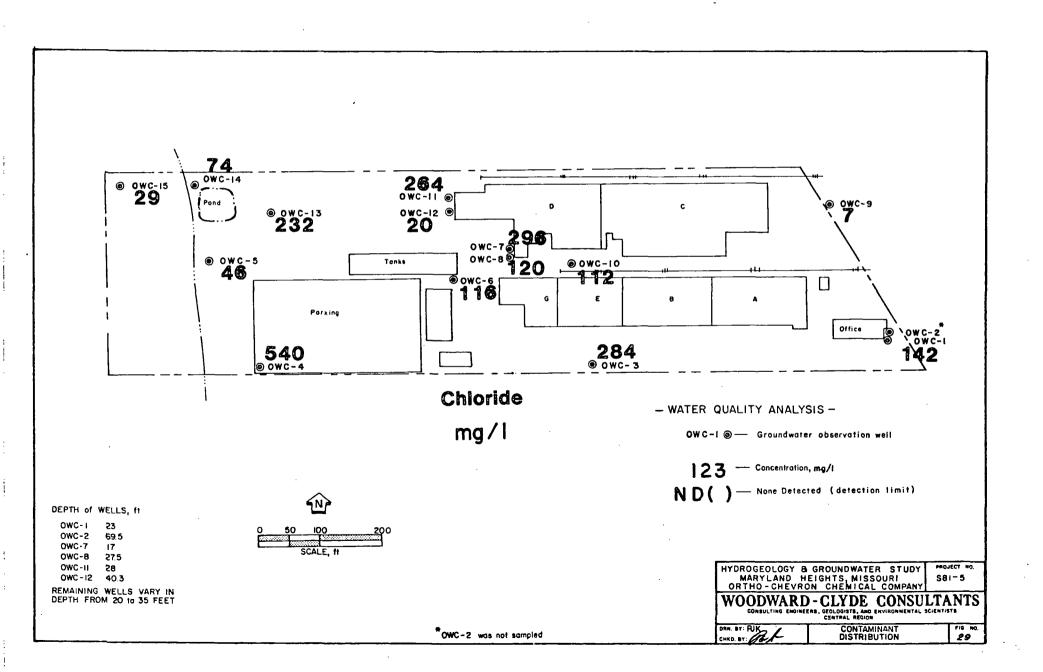


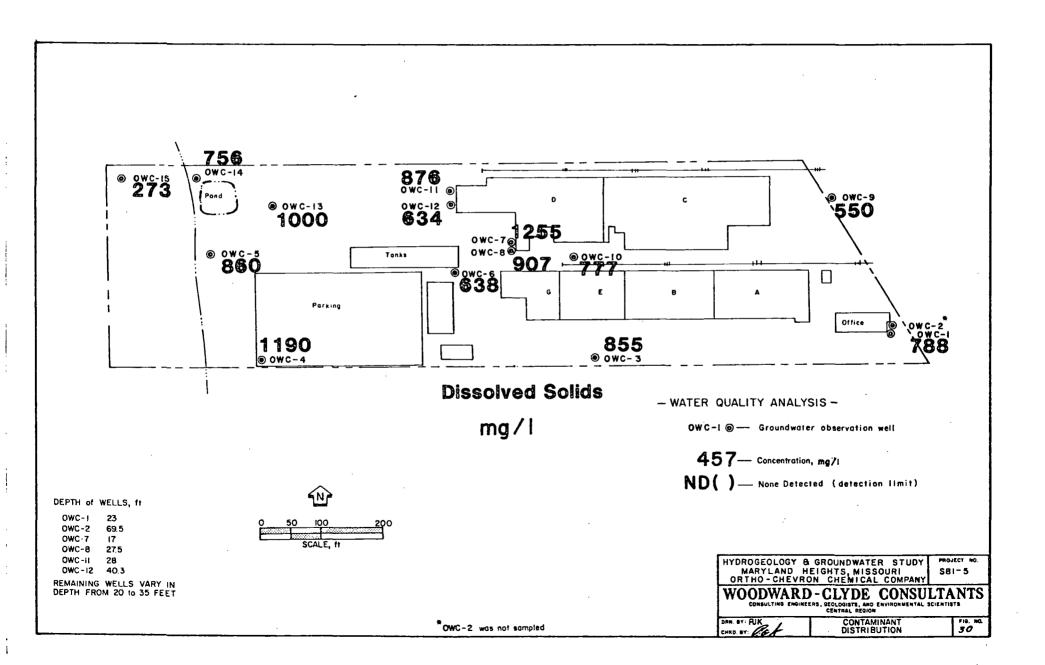


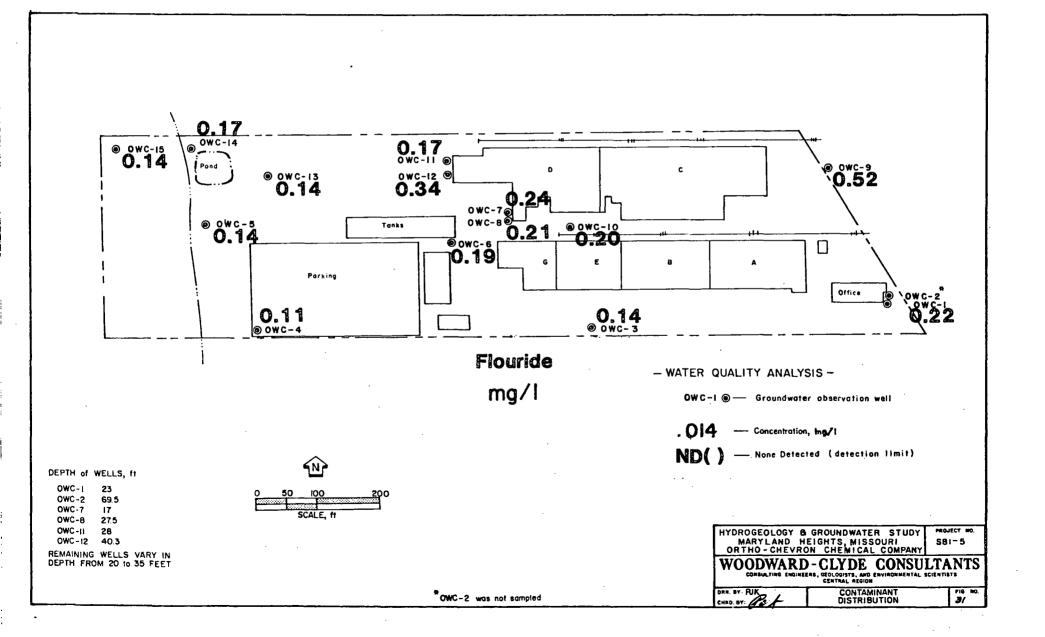


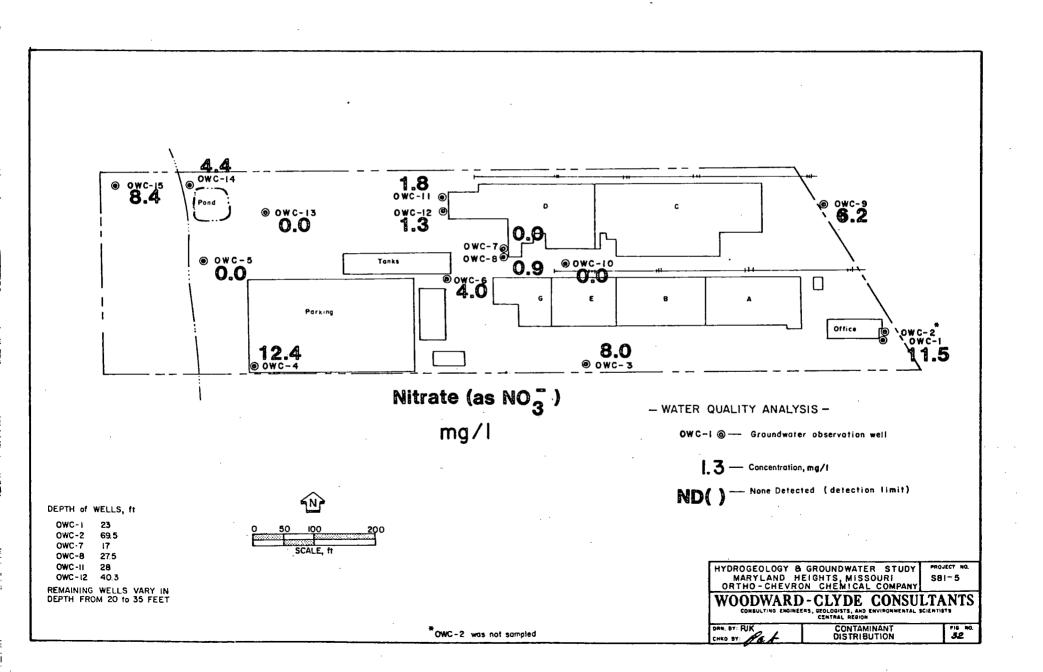


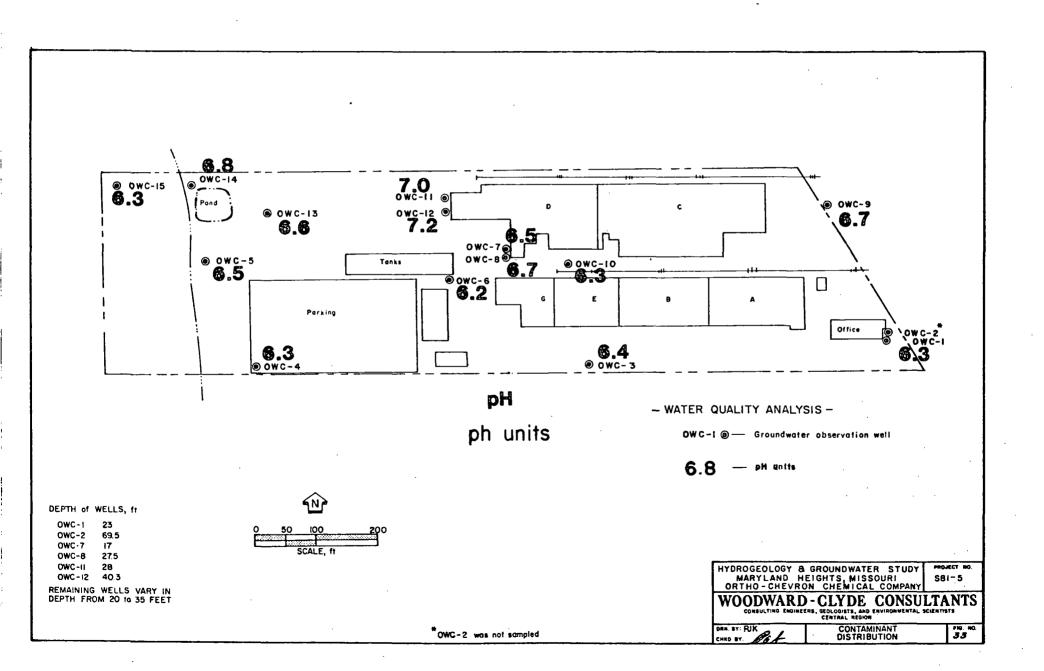


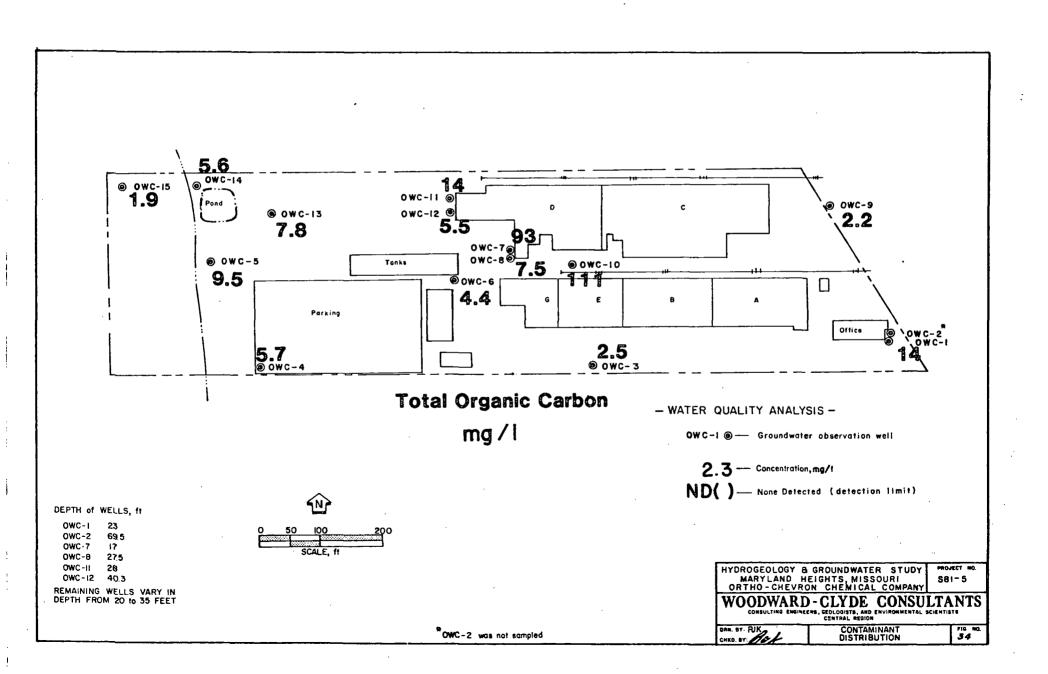


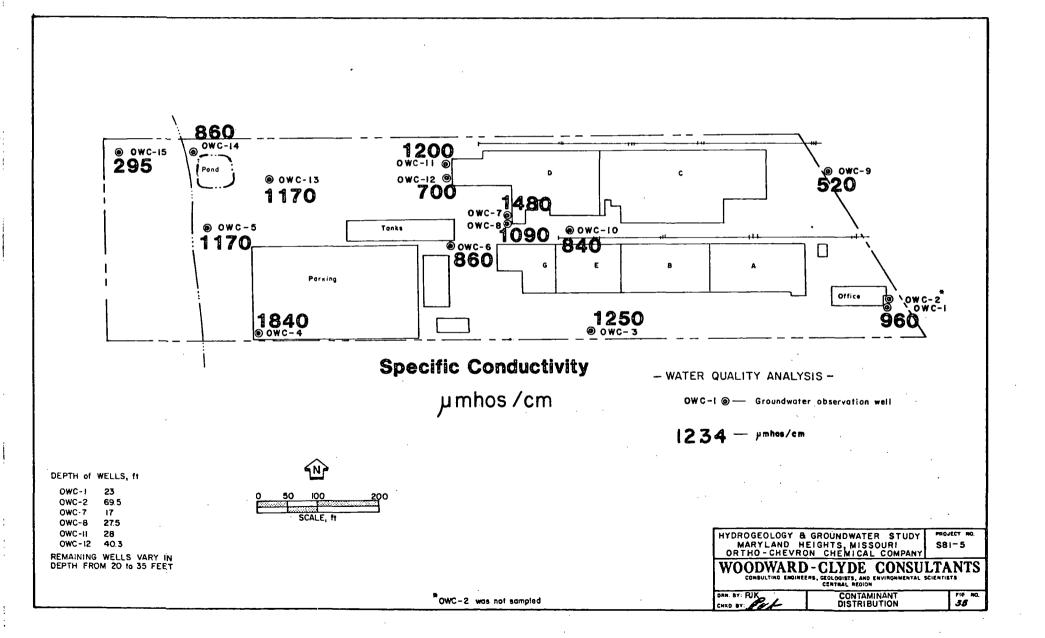


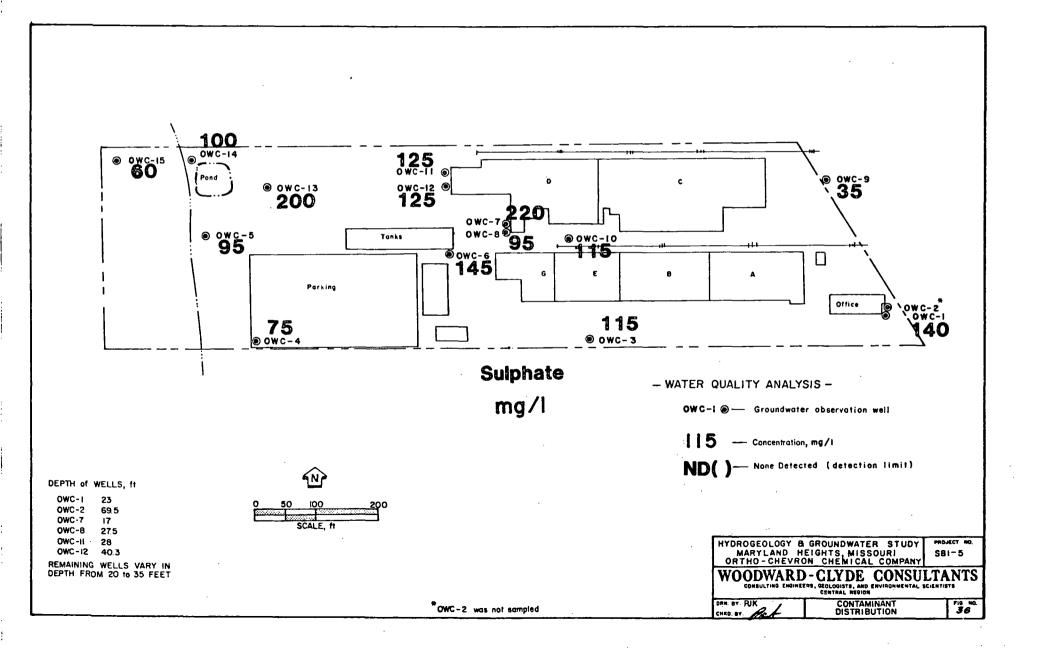












# APPENDIX A DETAILED LOGS OF BORINGS

#### LEGEND AND NOMENCLATURE

Items shown on boring logs refer to the following:

- 1. <u>Depth</u> Depth below reference elevation, ground surface unless otherwise shown.
- 2. Sample Types designated by letter
  - D Disturbed sample, obtained from auger cuttings or wash water for classification purposes only.
  - S Split-Spoon sample, obtained by driving 2-inch split-spoon to determine penetration resistance and allow classification.
  - C Liner tube sample, obtained by penetration of thick, wall sampler containing 2-inch diameter liner-tubes (California sampler).
  - U Undisturbed sample, obtained by penetration of minimum 3 inch diameter, thin-wall tube using an open or, where indicated, fixed-piston sampling head.
  - Rec Recovery is expressed as a ratio of the length recovered to the total length pushed or driven (in inches) i.e.  $\frac{8}{12}$

Resist - Resistance is designated as follows:

- P Sample pushed in one continuous movement by hydraulic rig action, maximum hydraulic pressure shown where pertinent.
- Numbers indicate blows per 6 inches of sampler penetration when driven by a 140-pound hammer falling freely 30 inches. The Standard Penetration Resistance is the number of blows for the last 12 inches of penetration of the split-spoon sampler, e.g. 15. Note that a blow count can be given for the California sampler, but this is not the Standard Penetration Resistance.
- 3. <u>Description</u> Description of material according to the Unified Soil Classification: word description gives soil constituents, consistency or density, and other appropriate classification characteristics. Unified Soil Classification symbols are shown on the USC column. Geologic names, where appropriate, are shown under Special Notes. A solid line indicates stratigraphic change; a dashed line indicates approximate location of stratigraphic change.
- 4. Special Notes and Field Observations Pertinent observations made by inspector during drilling including type of boring, free water level, water seepage, fluid loss, hole termination depth, etc.
- 5. Legend -

CFA - Continuous flight auger

ATD - At time of drilling

AD - After drilling

DWL - Drill water loss

DWR - Drill water return



Water depth at specified time after drilling

Water entry depth at time of drilling

|        |                           |  | SHEETOF2                                |
|--------|---------------------------|--|---|
| PROJEC | T NAME                    | ORTHO CHEVRON  | PROJECT NO. S81-5                       |
|        | B-201                     | PROJECT LOCATION ST. LOUIS, MISSOURI   | DATE 2/3/81 RIG CME 750                 |
| SURFAC | E ELEVATION _             | LOGGED BY Peter Barrett DRILLED BY G. Johanning 534 ELEVATION DATUM USC & GS | WATER ENTERS E1 524 ATD E1 529 24 hr AD |
| DEPTH  | SAMPLE<br>TYPE   REC   IR | DESCRIPTION  | U.S.C. SPECIAL NOTES AND                |

| DEPTH |             | SAMPLE   |          | DESCRIPTION   | U. S. C. | SPECIAL NOTES AND                                      |  |  |
|-------|-------------|----------|----------|---|----------|--|--|--|
| 0 -   | TYPE        |          | RESIST   | DESCRIPTION   | U. S. C. | FIELD OBSERVATIONS                                     |  |  |
| , ,   |             |          |          | Asphalt and Gravel FILL  Firm to stiff, brown, low plastic silty  Clay FILL         | F        | Boring advanced with 6-inch diameter hollow stem auger |  |  |
|       | С           | 14<br>18 | Р        |   | L        | -  |  |  |
| 5 _   | <del></del> |          |          | Firm to stiff, brown, low plastic Silty  — CLAY                                     | CL       | Modified loess<br>▼ 24 hrs AD                          |  |  |
| -     | С           | 12<br>18 | Р        | -   | <u> </u> | 24 III 5 AU  |  |  |
| -     |             |          |          | -<br>-  | 1        | -  |  |  |
| 10    |             |          |          | <u> </u>  |          | - ATD -  |  |  |
| 4     | С           | 16<br>18 | Р        | Becoming stiff, low to medium plastic with black iron deposits                      | -        | _  |  |  |
|       |             |          |          | -<br>-  |          | _<br>  |  |  |
| 15    |             |          | :        | <u> </u>  |          |  |  |  |
| -     | С           | 15<br>18 | Р        | Becoming medium to highly plastic   | CH-      |  |  |  |
| -     | į           |          |          | <u> </u>  |          | _  |  |  |
|       |             |          |          | -<br>-  |          | ·  |  |  |
| 20    | C           | 14<br>18 | P        | Hard, tan, brown, gray, highly plastic _<br>CLAY with trace of silt, and black iron | СН       | Residual _   |  |  |
| -     |             |          |          | CLAY with trace of silt, and black fron deposits                                    |          | _  |  |  |
| -     |             |          |          | -<br>-  |          | <u>-</u>   |  |  |
| 25    |             |          | <u>_</u> | WOODWARD-CLYDE CONSHITANTS  |          |  |  |  |

WOODWARD-CLYDE CONSULTANTS

FIGURE NO. A-1

| PROJECT | NAME        | ORTHO CHEVRON                                   | PROJECT NO. | OF2<br>       |
|---------|-------------|---|-------------|---------------|
|         |             | 7   | DATE        | 2-3-81        |
| 1       | B-201       | PROJECT LOCATION ST. LOUIS, MISSOURI            | RIG         | CME 750       |
| L       | <del></del> | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTE  | RS E1 524 ATD |
| SURFACE | ELEVATION . | 534 ELEVATION DATUM USC & GS                    | E1 529 24   | hr AD         |

| DEPTH | S    | AMPLE    |        | DEGGSTON  |          | SPECIAL NOTES AND              |
|-------|------|----------|--------|---|----------|--------------------------------|
|       | TYPE | REC      | RESIST | DESCRIPTION   | U. S. C. | FIELD OBSERVATIONS             |
| 25    | С    | 10<br>18 | Р      | SAME: Hard, multi-colored, highly plastic CLAY with shale fragments | СН       |                                |
| 1     |      | 10       |        | L CEAT WITH SHATE TRAGILETES  | 1        |                                |
| -     |      |          |        | _   | -        | Auger refusal Bottom of boring |
|       |      |          |        | _   | _        | 27 ft                          |
|       |      |          |        |   |          |                                |
| -     |      |          |        | -   | ┪        | _                              |
| 30    |      |          |        | _   | 4        |                                |
|       |      |          |        |   |          |                                |
| ٦     |      |          |        | •   | 1        |                                |
| _     |      |          |        | _   | -        |                                |
|       |      |          | ŀ      | _   | ]        |                                |
|       |      |          | 1      |   | 1.       |                                |
| -     |      |          |        | -   | 1        |                                |
|       |      |          |        | <del></del>   | _        |                                |
|       |      |          | }      | ·   | 1        |                                |
|       |      |          |        | -   |          |                                |
| -     |      |          | ŀ      | <del>-</del>  | ┨        |                                |
|       |      |          |        | _   | _        |                                |
|       |      |          |        |   |          |                                |
| -     |      |          |        | . · · · · · · · · · · · · · · · · · · ·                             | 1        | _                              |
|       |      |          |        |   | 4        |                                |
|       |      |          |        |   |          |                                |
|       |      |          |        | •••<br>·  | 1        |                                |
| 4     |      |          |        | -   | ┨        |                                |
| ا     |      |          |        | _   | ⅓        |                                |
|       |      |          |        |   |          |                                |
| 4     |      |          |        | -   | 1        | _                              |
|       |      |          |        |   | 4        | _                              |
|       |      |          |        |   | 1        |                                |
| 1     |      |          |        | -   | 1        | -                              |
| 4     |      |          |        | -   | -        | -                              |
|       |      |          |        | _   | ]        |                                |
| ٦     |      | İ        |        | <del>-</del>  | ]        |                                |
| 4     |      |          |        | -   | 1        | -                              |
|       |      |          |        |   | L        |                                |
|       |      |          |        | WOODWARD-CLYDE CONSULTANTS  |          | FIGURE NO. A-2                 |

| PROJECT NAME      | ORTHO CHEVRON   | PROJECT NO. S81-5        |
|-------------------|---|--------------------------|
| B-202             | PROJECT LOCATION ST. LOUIS, MISSOURI  | DATE 2/10/81 RIG CME 750 |
| D 202             | PROJECT LOCATION ST. LOUIS, MISSOURI  LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS El 513 ATI  |
| SURFACE ELEVATION | 526 ELEVATION DATUM USC & GS  |                          |

| JUNI A   | ,, | VALION       | 52     | ELEVATION DATUM USC & GS                                    | •        |                                      |
|----------|----|--------------|--------|---|----------|--------------------------------------|
| DEPTH    | S  | AMPLE<br>REC | RESIST | DESCRIPTION   | U. S. 0  | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 0 -      |    |              |        | Asphalt and Gravel FILL                                     | FIL      | Boring advanced                      |
| _        |    |              |        | Stiff, brown, low plastic Clayey SILT                       | CL       | with 6-inch - diameter hollow        |
| -        | С  | 9            | P      | with some root holes  | -        | stem auger —                         |
| -        |    | 9<br>14      |        | _   | 4        | -                                    |
|          |    |              |        | _   |          | · _                                  |
| 5        |    |              |        |   |          |                                      |
|          | С  | 9            | Р      | <del></del>   |          |                                      |
|          |    | 14           |        | <u>-</u>  | 7        | _                                    |
| -        |    |              |        | _   | 1        | -                                    |
| -        |    |              |        | <b>-</b>  | -        | -                                    |
| -        |    |              |        | _   | 4        | -                                    |
| 10       |    |              |        | <del></del> -   |          | Modified loess                       |
|          | C  | 14<br>14     | Р      | _   |          | _                                    |
|          |    |              |        | -   | 7        |                                      |
| -        |    |              |        | _   | 7        | _                                    |
| -        |    |              |        | _   | $\dashv$ | ◆ ATD -                              |
|          |    |              |        | _   | 4        | -                                    |
| 15       |    | 4 1.         |        |   | _        |                                      |
|          | С  | 14<br>14     | Р      |   |          |                                      |
|          |    | -            |        | Very stiff, brown with gray, highly<br>- plastic Silty CLAY | СН       |                                      |
|          |    |              |        | - קומטנופ טוונץ טבאו  | 7        | Transitional                         |
| -        |    |              | ĺ      | -   | 7        |                                      |
| -        |    |              |        | _   | 4        | _                                    |
| 20       | С  | 14           | Р      | <del></del>   | -        |                                      |
|          | ١  | 14           |        | -   | _        |                                      |
|          |    |              |        | _   |          |                                      |
|          |    |              |        | _   | 7        |                                      |
| 7        |    |              | 1      | Hard, gray, Shaley CLAY                                     | CH-      | Residual                             |
| <u> </u> |    |              | Ì      |   | -SH      |                                      |
| 25       |    |              | 1      | SHALE: Hard, gray, weathered                                | SH       |                                      |
|          |    |              |        | WOODWARD-CLYDE CONSULTANTS                                  |          | FIGURE NO. A-3                       |

|                   |   | SHEET OF                |
|-------------------|---|-------------------------|
| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5       |
|                   |   | DATE 2/10/81            |
| B-202             | PROJECT LOCATION ST. LOUIS, MISSOURI            | RIG CME 750             |
|                   | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS ET 513 ATT |
| SURFACE ELEVATION | F26   |                         |

| DEPTH SAMPLE TYPE REC RESIST |      |     | DESCRIPTION | U.S.C                              | SPECIAL NOTES AND |                                      |
|------------------------------|------|-----|-------------|------------------------------------|-------------------|--------------------------------------|
| 25 -                         | TYPE | REC | RESIST      | DESCRIPTION                        |                   | SPECIAL NOTES AND FIELD OBSERVATIONS |
| -,                           | С    | 7/7 | Р           | SAME: SHALE: Hard, gray, weathered | SH                |                                      |
| -                            |      |     |             | -                                  | -                 | -                                    |
| _                            |      |     |             | _                                  | _                 |                                      |
|                              |      |     |             |                                    |                   |                                      |
| -                            |      |     |             | -                                  | ┥                 | <b>-</b>                             |
|                              |      |     |             | _                                  |                   | -                                    |
|                              |      |     |             |                                    | 1                 |                                      |
| 30                           |      |     |             | <del></del>                        | ┥                 | Rottom of Boring                     |
| 4                            |      |     |             | _                                  | 4                 | Bottom of Boring<br>30 ft            |
|                              |      |     |             |                                    |                   |                                      |
| 4                            |      |     |             | -                                  | -                 | -                                    |
| _                            |      |     |             | <del>-</del>                       | _                 | _                                    |
|                              |      |     |             |                                    |                   |                                      |
| -                            | i    |     |             | _                                  |                   | _                                    |
| _                            |      |     |             | <u> </u>                           | _                 | <u></u>                              |
|                              |      |     |             |                                    |                   |                                      |
| -                            |      |     |             | -                                  | ┪                 |                                      |
| _                            |      |     |             | _                                  | _                 | _                                    |
|                              |      |     |             |                                    |                   |                                      |
|                              |      |     |             | -                                  | ┪                 | -                                    |
| 4                            |      |     |             | _                                  | _                 | _                                    |
|                              |      |     |             |                                    |                   |                                      |
| ⊣                            |      |     |             |                                    | ┪                 |                                      |
| 4                            |      |     |             | _                                  | 4                 | _                                    |
|                              |      | !   |             |                                    | İ                 |                                      |
| ┪                            |      |     |             | -                                  | 7                 |                                      |
| 4                            |      |     |             | =                                  | _                 | _                                    |
|                              |      |     |             |                                    |                   |                                      |
| ┪                            |      |     |             | -                                  | 1                 | -                                    |
|                              |      |     |             | <u> </u>                           | 4                 |                                      |
|                              | -    |     | 1           |                                    | 1                 |                                      |
| Ⅎ                            |      |     | ŀ           | -                                  | -                 | _                                    |
| 4                            |      |     |             | _                                  | 4                 | _                                    |
|                              |      |     |             |                                    |                   |                                      |
| 4                            |      |     | ŀ           | •                                  | $\dashv$          | -                                    |
|                              | ł    |     | Ĺ           | -                                  | _                 | _                                    |
| l                            |      |     |             |                                    |                   | İ                                    |
|                              |      |     | <u>.</u>    | WOODWARD-CLYDE CONSULTANTS         | 1                 | FIGURE ALC: 1                        |
|                              |      |     |             | MOADMYUD.AFINE CAUSAFIXUIS         |                   | FIGURE NO. A-4                       |

|              |             |  |              |             | DOMINO LOO                               | SHEET1OF2 |   |  |
|--------------|-------------|--|--------------|-------------|--|-----------|---|--|
| PROJECT NAME |             |  |              |             | ORTHO CHEVRON                            |           | EET OF ROJECT NO. S81-5                 |  |
| B-203 PR     |             |  |              |             | ST. LOUIS, MISSOURI                      | 1/26/81   |   |  |
|              |             |  |              | ROJEC       | T LOCATION                               | RI        | G CME 750                               |  |
|              |             |  |              |             | BY Peter Barrett DRILLED BY G. Johanning | _ W       | ATER ENTERS None ATD<br>1 498 24 hr AD  |  |
| SURFA        | CE ELE      | EVATION  | ·2           | <u>' /</u>  | ELEVATION DATUM USC & GS                 | _ =       | 1 |  |
| DEPTH        | TYPE        | AMPLE<br>I REC                                   | RESIST       | $ar{}$      | DESCRIPTION                              | U. S. C.  | SPECIAL NOTES AND FIELD OBSERVATIONS    |  |
| 0 -          |             |  |              |             | Stiff, brown, silty Clay FILL            | FILL      | Boring advanced                         |  |
| -            | С           | 3<br>18  | Р            | t           |  | 1         | with 6-inch -<br>diameter hollow        |  |
| -            |             | 18   |              | <b>-</b>    |  | -         | stem auger -                            |  |
| -            | С           | 2  | P            | 1           |  | -{        | _                                       |  |
| _            | "           | 18   | '            |             | Stiff, brown, Silty CLAY                 | CL        | _                                       |  |
| 5            |             |  |              | 1           | _  |           |   |  |
|              | С           | <u>3</u><br>18                                   | Р            |             | _  | 7         |   |  |
| -            | <u> </u>    | 10   | ļ            |             |  | 7         | <u>-</u>                                |  |
| -            | ł           |  |              | -           |  | +         | <del>-</del>                            |  |
| -            | İ           |  |              | L           |  | 4         | _                                       |  |
| } _          | ]           |  |              | L           | ·  | _]        | _                                       |  |
| 10           |             |  |              |             | Becoming very silty                      | CL-       |   |  |
| '"-          | C           | 2<br>18  | Р            |             |  | ML        | Modified loess —                        |  |
| -            | ł           | 18   |              | -           |  |           | -                                       |  |
| _            |             |  |              | <b> </b>    |  | 4         |   |  |
| _            |             |  |              | L           |  |           | · _                                     |  |
|              | ]           | ļ  | İ            | Γ           |  | 1         |   |  |
| -            |             |  |              | F           | •  | 1         | <u>-</u>                                |  |
| 15           | С           | 2  | P            | <b> -</b> - | _  | -         |   |  |
| _            |             | 2<br>18  | ļ .          | L           |  | <u> </u>  |   |  |
|              | <del></del> | <del>                                     </del> | <del> </del> | L           |  | ]         | _                                       |  |
|              |             | }  |              |             |  |           |   |  |
| -            |             |  |              | <u> </u>    |  | 1         | -                                       |  |
| ] -          |             |  |              | -           | Very stiff, brown, Silty CLAY with sand  | - сн      | _₩ 24 hr AD _                           |  |
| 20           | С           |  | P            | _           | and gravel                               | _         | •                                       |  |
|              | , c         | 2<br>18  | ] [          |             |  |           | Residual —                              |  |
|              | <del></del> |  |              |             | •  | ]         | Nesidual =                              |  |
|              | ,           |  |              | <b> </b>    | · •                                      | 1         | _                                       |  |
| -            |             |  |              | F           |  | -{        | _                                       |  |
| _            |             |  |              | _           | •  | 4         | _                                       |  |
| اعدا         |             | 1  | i            |             |  |           |   |  |

WOODWARD-CLYDE CONSULTANTS

FIGURE NO. A-5

| PROJECT NAME        | ORTHO CHEVRON  | PROJECT NO. S81-5                       |
|---------------------|--|---|
| B-203               | PROJECT LOCATION ST. LOUIS, MISSOURI   | DATE 1/26/81<br>RIG CME 750             |
| SURFACE ELEVATION _ | LOGGED BY Peter Barrett DRILLED BY G. Johanning 517 ELEVATION DATUM USC & GS | WATER ENTERSNONE ATD<br>E1 498 24 hr AD |

| DEPTH | S    | AMPLE   |           | DESCRIPTION                      |             | U. S. C.   | SPECIAL  | NOTES AND<br>SERVATIONS | ,        |
|-------|------|---------|-----------|----------------------------------|-------------|------------|----------|-------------------------|----------|
| 25 -  | TYPE | REC RES | 51        |                                  | CLAV        | СН         |          |                         |          |
| _     |      |         |           | SAME: Very stiff, highly plastic |             | <b> </b>   | Auger re |                         | ı,       |
|       |      |         |           | LIMESTONE                        |             | LS         | Bottom o | of boring<br>of ft      |          |
|       |      |         |           |                                  | _           |            |          |                         |          |
| -     |      |         | F         |                                  | -           | ł          | 1        | ٠.                      | _        |
| <br>  |      |         |           |                                  | _           | 1          |          |                         | -        |
| 30    |      |         | -         |                                  |             |            |          |                         |          |
|       |      |         |           |                                  | -           | 1          |          |                         |          |
| -     |      |         | <b>†</b>  |                                  | -           | ĺ          |          |                         | -        |
| -     |      |         | ļ.        |                                  | -           | 1          |          |                         |          |
|       |      |         | L         |                                  | _           | ]          |          |                         |          |
|       |      |         | _         |                                  | _           | ]          |          |                         | _        |
| -     |      |         | <b> </b>  |                                  | -           | 1          |          |                         | -        |
|       |      |         | -         |                                  |             | ł          | 1        |                         |          |
| ا     |      |         | L         |                                  |             | <u> </u>   |          |                         |          |
|       |      |         |           |                                  |             |            |          |                         |          |
|       |      |         | 上         |                                  | _           | 1          |          |                         |          |
| -     |      |         | $\vdash$  |                                  | -           | 1          |          |                         |          |
|       |      |         |           |                                  | -           |            |          |                         | _        |
|       |      |         | 1         |                                  |             |            | il:      |                         |          |
|       |      |         |           |                                  | -           | 1          |          |                         |          |
| -     |      |         | <u> -</u> |                                  | -           | {          |          |                         | _        |
| -     |      |         | <b>L</b>  |                                  | _           |            |          |                         |          |
|       |      |         |           |                                  |             | ļ          |          |                         |          |
|       |      |         |           |                                  | _           | 1          |          |                         |          |
|       |      |         | -         |                                  | _           | -          | 1        |                         | -        |
|       | 1    |         | <u> </u>  |                                  |             | Ì          |          |                         |          |
|       |      | ļ       |           |                                  |             | <b>!</b> ; | Į        |                         |          |
|       |      |         |           |                                  | _           |            |          |                         | ٦        |
| -     |      |         | <b>+</b>  |                                  | -           |            |          |                         | -        |
|       |      |         | <b> </b>  |                                  |             |            |          |                         | 4        |
|       |      | }       |           |                                  |             |            |          |                         |          |
| 7     |      |         | Γ         |                                  | _           |            |          |                         | 7        |
|       |      |         |           | WOODWARD-CLYDE CONSULTANTS       | <del></del> | i          |          | NO A                    | <b>:</b> |
|       |      |         |           | WASSAUGH OF THE COMPOSITION      |             |            | FIGURE   | NOA-                    | <u> </u> |

| PROJECT NAME      | ORTHO CHEVRON  | PROJECT NO. S81-5       |
|-------------------|--|-------------------------|
| B-204             | PROJECT LOCATIONST. LOUIS, MISSOURI  | DATE 2/9/81 RIG CME 750 |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning 514 ELEVATION DATUM USC & GS | WATER ENTERS E1 489 ATD |

|       | -    | AA45: 5      |          |   |         | T opposed alege and                  |
|-------|------|--------------|----------|---|---------|--------------------------------------|
| DEPTH | TYPE | AMPLE<br>REC | RESIST   | DESCRIPTION   | U. S. 0 | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 0 -   | С    | 11           | Р        | Firm to stiff, brown Clay FILL                            | FILL    |                                      |
| -     | Ŭ    | 18           | <u>'</u> | Stiff, gray and brown, low plastic                        | CL      | -<br>-                               |
| 5     | C    | 13<br>18     | Р        | - Silty CLAY  |         | Stream deposit                       |
| -     | U    | 13<br>18     | P        | With organics   |         |                                      |
| 10    |      |              |          |   |         |                                      |
|       | С    | 13<br>18     | Р        | Firm to stiff, brown, low plastic Silty CLAY              | +       | Modified loess                       |
| -     |      |              |          | -<br>-  |         | _                                    |
| 15    | С    | 16           | P        | Becoming low to medium plastic                            | -       | _                                    |
| -     |      | 16<br>18     |          | <u>-</u>  |         |                                      |
| -     |      |              |          |   | -       |                                      |
| 20    | С    | 13<br>18     | Р        | Stiff to hard, gray, highly plastic  CLAY with trace silt | CH      | Residual                             |
| -     |      |              |          | <u>.</u>  |         | -                                    |
| 25    |      |              |          | -   | -       | _                                    |
|       |      |              |          | WOODWARD-CLYDE CONSULTANTS                                |         | FIGURE NO. A-7                       |

| PROJECT NAME      | ORTHO CHEVRON  | PROJECT NO. S81-5          |
|-------------------|--|----------------------------|
| B-204             | PROJECT LOCATION ST. LOUIS, MISSOURI   | DATE 2/9/81<br>RIG CME 750 |
| SURFACE ELEVATION | LOGGED BY <u>Peter Barrett</u> DRILLED BY <u>G. Johanning</u> 514 ELEVATION DATUM USC & GS | WATER ENTERS E1 489 ATT    |

| DEPTH SAMPLE |      |          | DESCRIPTION | u.s.c.  | SPECIAL NOTES AND |                           |
|--------------|------|----------|-------------|---|-------------------|---------------------------|
| 25 –         | TYPE | REC      | RESIST      |   | <b>↓</b>          | FIELD OBSERVATIONS        |
|              | С    | 11<br>18 | P           | SAME: Stiff to hard, gray, highly<br>plastic CLAY | СН                | ATD _                     |
| 1            |      |          |             |   |                   |                           |
| _            |      |          |             | With rock fragments                               |                   | _                         |
|              |      |          |             | ,   |                   | _                         |
| 30           |      |          |             | -<br>-  |                   |                           |
| , Jo         |      |          |             |   | 1                 | Auger refusal             |
| -            |      |          |             | LIMESTONE   | LS                | Bottom of boring<br>31 ft |
| _            |      |          |             | <b>-</b>  | 1                 | _                         |
| _            |      |          |             | -<br>-  | 1                 | <del>-</del>              |
|              |      |          |             | -   | 1                 | _                         |
| -            |      |          |             | <del>-</del>                                      | 1                 | · · · —                   |
| -            |      |          |             | -   | 1                 | _                         |
| _            |      |          |             | -   | ┨                 | _                         |
| -            |      |          |             |   | 1                 | _                         |
| -            |      |          |             | <del>-</del>                                      |                   | _                         |
| -            |      |          |             | _   | -                 |                           |
| -            |      |          |             | -   | 1                 | _                         |
|              |      |          |             | -   | <u> </u>          | _                         |
| 4            |      |          |             | -   | 1                 | _                         |
| 4            |      |          |             | <del>-</del>                                      | <u> </u>          | -                         |
| 4            |      |          |             | <del></del>                                       | $\frac{1}{2}$     |                           |
| 4            |      |          |             | -   |                   | _                         |
| 4            | l    | ·        |             |   |                   |                           |
|              |      |          |             |   |                   | -                         |
|              |      |          |             | <u> </u>  |                   | _                         |
| $\perp$      |      |          |             |   |                   |                           |
|              |      |          |             | WOODWARD-CLYDE CONSULTANTS                        |                   | FIGURE NO. A-8            |

|                   |                                      |                            | SHEETOF                |
|-------------------|--------------------------------------|----------------------------|------------------------|
| PROJECT NAME      | ORTHO CHEVRON                        | •                          | PROJECT NO. S81-5      |
|                   |                                      |                            | DATE 1/26/81           |
| B-205             | PROJECT LOCATION ST. LOUIS, MISSOURI | RIG CME 750                |                        |
| <u></u>           | LOGGED BY Peter Barre                | tt DRILLED BY G. Johanning | WATER ENTERSET 506 ATD |
| SURFACE ELEVATION |                                      |                            | E1 509 24 hr AD        |
| ·                 |                                      |                            |                        |

| DEPTH | S    | AMPLE    |        | DESCRIPTION  | U.S. | SPECIAL NOTES AND             |
|-------|------|----------|--------|--|------|-------------------------------|
| 0 -   | TYPE | REC      | RESIST | DESCRIPTION TO THE PROPERTY OF |      | FIELD OBSERVATIONS            |
|       | С    | 9        | P      | Stiff, brown, low plastic silty Clay<br>FILL with cinders and gravel   | FIL  | Boring advanced with 6-inch   |
| _     |      | 18       | r      |  | 4    | diameter hollow<br>stem auger |
| _     | С    | 13<br>18 | P      | - Stiff, dark gray-brown, low plastic<br>Silty CLAY  | - CL | Stream deposit -              |
| -     | ·    | 10       |        | •  | 4    | -                             |
| 5_    | С    | 14       | P      | <del></del>  | -    |                               |
|       |      | 18       |        | •  | 4    | _                             |
| -     | С    | 14       | Р      | Stiff, brown, Silty CLAY   |      | ▼ 24 hrs AD<br>Modified Loess |
| _     |      | 18       |        | -  | -    | -                             |
|       |      |          |        | -  | 4    | -                             |
| 10_   | С    | 14<br>18 | Р      | •••  |      | ATD                           |
|       |      | 10       |        | •  |      | -                             |
| -     |      |          |        | <b>-</b>   |      | _                             |
|       |      |          |        | -  |      | _                             |
| 15    |      | ·        |        | •  |      |                               |
|       | С    | 14<br>18 | Р      | _  |      | -                             |
|       |      | , ,      |        | •<br>_   |      |                               |
|       |      |          |        | -  |      |                               |
|       |      |          |        | _  |      |                               |
| 20    |      |          |        |  |      |                               |
|       | C    | 14<br>18 | Р      | <u>.</u>   |      |                               |
|       |      |          |        | -  |      |                               |
|       |      |          |        |  |      | _                             |
|       |      |          |        | <ul><li>Very stiff, brown, highly plastic Silty</li><li>CLAY with rock fragments</li></ul>   | CH   | Residual -                    |
| 25    |      |          |        |  |      |                               |
|       |      |          |        | WOODWARD-CLYDE CONSULTANTS   | •    | FIGURE NO. A-9                |

| PROJECT NAME        | ORTHO CHEVRON                                   | PROJECT NO. S81-5        |
|---------------------|---|--------------------------|
| B-205               | PROJECT LOCATION ST. LOUIS, MISSOURI            | DATE 1/27/81 RIG CME 750 |
|                     | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS E1 506 ATT  |
| SURFACE ELEVATION _ | ELEVATION DATUM USC & GS                        | E1 303 24 III AD         |

| DEPTH | S<br>TYPE | AMPLE | RESIST |   | DESCRIPTION                             |   | U. S. C. | SPECIAL NOTES AND FIELD OBSERVATIONS |
|-------|-----------|-------|--------|---|---|---|----------|--------------------------------------|
| 25 –  | C         | 6     | P      |   | SAME: Very stiff, brown, highly plastic |   | СН       | . ILLO OBOLINYALIONO                 |
| -     |           | 18    |        | } | Silty CLAY with rock fragments          | - |          | -                                    |
| ] _   |           |       |        | - |   | _ |          |                                      |
|       |           |       |        |   | · · · · · · · · · · · · · · · · · · ·   |   |          |                                      |
|       |           |       |        |   | LIMESTONE                               |   | LS       | Bottom of Boring<br>28 ft            |
| -     |           |       |        | r |   |   |          | 20 11                                |
| 30    |           |       |        | - |   | - |          |                                      |
| -     |           |       |        | - |   | _ |          | -                                    |
| _     |           |       |        | L |   |   |          |                                      |
|       |           |       |        | ľ |   | İ |          |                                      |
|       |           |       |        | Γ |   | - |          | 7                                    |
| _     |           |       |        |   |   | _ |          |                                      |
|       |           |       |        | - |   | _ |          |                                      |
| _     |           |       |        | L |   | _ |          | _                                    |
|       |           |       |        | L |   |   |          | _                                    |
|       |           |       |        |   |   |   |          | · 7                                  |
| -     |           |       |        | r |   | - |          |                                      |
| -     |           |       |        | ├ |   | - |          | -                                    |
|       |           |       | :      |   |   |   |          |                                      |
|       |           |       |        | L |   |   | ]        |                                      |
|       |           |       |        |   |   |   |          | ·                                    |
| ~     |           |       |        |   |   | ٦ |          |                                      |
| _     |           |       |        | - |   | - |          | -                                    |
|       |           |       |        | _ |   | _ |          | -                                    |
|       |           |       |        | L |   |   |          |                                      |
|       |           |       |        | ] |   |   |          |                                      |
|       |           |       |        |   |   | ٦ |          | †                                    |
| -     |           |       | }      | H |   | - |          | -                                    |
|       |           |       |        | L |   | 4 |          | · 4                                  |
|       |           |       |        | L |   |   |          |                                      |
|       |           |       |        | L |   |   |          |                                      |
|       |           |       |        | - | WOODWARD-CLYDE CONSULTANTS              |   |          | FIGURE NO. A-10                      |

| PROJECT NAME      | ORTHO CHEVRON  | PROJECT NO. <u>\$81-5</u>   |
|-------------------|--|-----------------------------|
| B-206             | PROJECT LOCATION ST. LOUIS, MISSOURI   | DATE 2/13/81<br>RIG CME 750 |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning 518 ELEVATION DATUM USC & GS | WATER ENTERS E1 503 ATD     |

|       | CE ELE   |              |        | ELEVATION DATUM 030 0 43                      |          |                                      |
|-------|----------|--------------|--------|---|----------|--------------------------------------|
| DEPTH | TYPE     | AMPLE<br>REC | RESIST | DESCRIPTION                                   | U. S. C  | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 0 -   |          |              |        | 3 inches asphalt                              |          | Panina advanced                      |
| -     | -        |              |        | Firm, brown Clay FILL with gravel and cinders | - FIL    | with 6-inch                          |
| _     |          |              |        | - Citide is                                   |          | diameter hollow                      |
|       | С        | 15<br>18     | Р      |   |          | stem auger                           |
| -     | <u> </u> | 10           |        | -   | 4        |                                      |
| _     |          |              |        |   |          |                                      |
| 5     | ·        | 1            |        | Stiff, gray with brown, low plastic           | CL       | Stream deposit                       |
|       | С        | 12           | P      | - Silty CLAY                                  | 7        | _                                    |
| -     | ·        | 18           | ŀ      | _   | 4        |                                      |
|       |          |              |        |   |          |                                      |
|       | С        | 1 <u>3</u>   | Р      | Stiff, brown, low plastic Silty CLAY          | 7        | Modified loess                       |
| -     | 1        | או           |        | <del>-</del>                                  | 4        |                                      |
| _     |          |              |        | _   |          |                                      |
| 10    |          |              |        |   | ļ        |                                      |
| -     | С        | 15<br>18     | Р      | Becoming low to medium plastic                | -        | -                                    |
| -     |          | 18           |        | -   | 4        |                                      |
|       |          |              |        | _   |          | _                                    |
| -     |          | ·            |        | _   | 7        |                                      |
| -     |          | ļ            |        | -   | 4        |                                      |
| _     |          |              |        | <u>-</u>                                      |          |                                      |
| 15    |          | ŀ            |        |   |          |                                      |
| '>    | С        | 13           | Р      | <del></del>                                   |          | ATD -                                |
| j -   |          | 13<br>18     |        | -   | 4        | -                                    |
|       |          |              |        |   |          |                                      |
| -     |          |              |        | _   | 7        |                                      |
| -     | }        |              |        | -   | $\dashv$ | -                                    |
| _     |          |              |        | - Stiff to hard, brown, highly plastic        | - CH     |                                      |
| 20    | ]        |              |        | CLAY with trace silt                          | "        |                                      |
| -     | С        | 16           | Р      | <del></del>                                   | _        | _                                    |
| _     |          | 18           |        | _   | 4        |                                      |
|       |          |              |        |   |          |                                      |
| -     |          |              |        | -   | 7        | •                                    |
| ] -   |          |              |        | - Becoming red-purple                         | 4        |                                      |
|       |          |              |        | _   |          | _                                    |
| 25    |          |              |        |   |          |                                      |
|       |          |              |        | WOODWARD-CLYDE CONSULTANTS                    |          | TIQUES NO. 111                       |
|       |          |              |        | MAGAMMUR-PLINE PRESCRINGIS                    |          | FIGURE NO. A-11                      |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5        |
|-------------------|---|--------------------------|
| B-206             | PROJECT LOCATIONST. LOUIS, MISSOURI             | DATE 2/13/81 RIG CME 750 |
|                   | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS E1 503 ATD  |
| SURFACE ELEVATION | 518 ELEVATION DATUM USC & GS                    |                          |

| DEPTH | S | AMPLE | RESIST | DESCRIPTION                            | U. S. C. | SPECIAL NOTES AND                                |
|-------|---|-------|--------|--|----------|--|
| 25    |   |       |        |  | J. J. U. | FIELD OBSERVATIONS                               |
| -     | S | 3/3   | 30/3   | SAME: Hard, red-purple CLAY  LIMESTONE | LS       | Bottom of boring<br>25.3 ft -<br>Auger refusal - |
| _     | i |       |        | -                                      |          |  |
| _     |   |       |        | -<br>                                  |          |  |
| 30    |   |       |        | -                                      |          | _  |
| -     |   | II    |        | -                                      |          | _  |
|       |   |       |        | -<br> -<br> -                          |          |  |
|       |   |       |        | _                                      | }        |  |
| -     |   |       |        | _                                      |          |  |
| -     |   |       |        | -<br>-                                 | 1        | -  |
| -     |   |       |        |  |          | _  |
|       | i | ,     |        |  |          |  |
|       |   |       |        | -<br>-                                 |          | ]  |
| -     |   |       |        | -                                      |          | _  |
|       |   |       |        |  | 1        | _  |
|       |   |       |        |  |          | -  |
| -     |   |       |        | _                                      |          | -  |
|       |   |       |        | -                                      |          | _  |
|       |   |       |        | <del></del>                            |          |  |
|       |   |       |        | WOODWARD-CLYDE CONSULTANTS             |          | FIGURE NO. A-12                                  |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. <u>S81-5</u> |
|-------------------|---|--------------------------|
| B-207             | PROJECT LOCATION ST. LOUIS, MISSOURI            | DATE 2/2/81 RIG CME 750  |
| CUREACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS EL 510 ATT  |

| DEPTH | 9           | SAMPLE         |          | DESCRIPTION                               | u.s.c.   | SPECIAL NOTES AND             |
|-------|-------------|----------------|----------|---|----------|-------------------------------|
| 0 -   | TYPE        | REC            | RESIST   | DESCRIPTION                               |          | FIELD OBSERVATIONS            |
|       |             |                |          | Stiff, brown, silty Clay FILL with gravel | FILL     |                               |
| -     | C-          | 14             | Р        | - and organics                            | 1        | with 6-inch                   |
| 1 _   | i           | 18             |          | _   | ال       | diameter hollow<br>stem auger |
|       |             | ļ              | <u> </u> |   | 7        | Some odor                     |
| -     | C           | 11             | P        | -   | 4        | <b>!</b> →                    |
|       | `           | 18             | '        |   | ł        |                               |
| -     | L           |                |          | <u> </u>                                  | 7        | 1                             |
| 5     |             |                |          | Firm to stiff, brown, low to medium       | CL       |                               |
|       | С           | <u>10</u>      | Р        | plastic Silty CLAY                        | ""       | ·                             |
| -     |             | 18             |          | -   | ┥        | -                             |
| 1     |             |                |          |   |          |                               |
| -     | C           | 12<br>18       | Р        | -   | 7        |                               |
| _     |             | 18             |          | _ With some gray                          | 4        | Modified loess                |
| 1     | <del></del> |                |          |   | ŀ        |                               |
| -     |             |                |          | <del>-</del>                              | ┨        | 1                             |
| 10    | <u>.</u>    |                |          | _   |          | ATD                           |
| ]     | С           | 13<br>18       | Р        | <del></del>                               |          |                               |
| _     | 1           | 18             |          | _   | _        |                               |
| 1     | <b></b>     | <del></del>    |          |   |          |                               |
| -     |             |                |          | _   | ┪        | -                             |
| Ì     |             |                |          |   | ļ        | i                             |
|       |             |                |          | -   | 7        | 1 7                           |
| _     |             | !              |          | -   | 4        |                               |
| 1.5   |             |                |          |   | ł        |                               |
| 15_   | С           |                | Р        | <del></del>                               | ┪╴       |                               |
| l _   | ١           | <u>0</u><br>18 | ] [      |   | _        |                               |
| 1 -   |             | '              |          | _   | 7        |                               |
| -     |             |                | [        | _   | 4        | 1 -                           |
|       |             |                |          |   |          |                               |
| -     |             |                |          | -   | 4        | -                             |
|       |             |                |          | _   |          |                               |
|       |             |                |          | _   | 7        |                               |
| 20    | С           | 14             | P        | Becoming more tan-brown, medium plastic,  | 4        | Transitional to               |
|       |             | 18             | '        | with black deposits                       |          | residual                      |
| +     |             |                |          | •   | 4        |                               |
|       |             |                |          | _   |          | ]                             |
|       |             |                |          | <del>-</del>                              | 7        | 1                             |
| 4     |             |                |          |   | <b>_</b> | ]                             |
|       |             |                |          | Hard, multicolored, highly plastic CLAY   | СН       |                               |
| -     |             |                |          | - with silt and fine sand                 | ┪        | Residual                      |
| 25    |             |                |          |   | <u> </u> |                               |
|       |             |                |          | WOODWARD-CLYDE CONSULTANTS                |          | FIGURE NO. A-13               |
|       |             |                |          |   |          | I IOUNL INO.                  |

| PROJECT NAME      | ORTHO CHEVRON        |                              |       | No. <u>S81-5</u>  |
|-------------------|----------------------|------------------------------|-------|-------------------|
| B-207             | PROJECT LOCATION     | ST. LOUIS, MISSOURI          | DATE  | 2/2/81<br>CME 750 |
| SURFACE ELEVATION | LOGGED BY Peter Barr | cett DRILLED BY G. Johanning | WATER | ENTERS El 510 ATD |

|               | DELEVATION DATUM 030 6 03 |              |        |   |               |                                      |  |  |
|---------------|---------------------------|--------------|--------|---|---------------|--------------------------------------|--|--|
| DEPTH<br>25 - | TYPE                      | AMPLE<br>REC | RESIST | DESCRIPTION   | U. S. C.      | SPECIAL NOTES AND FIELD OBSERVATIONS |  |  |
| 25 -          | С                         | 7/9          | Р      | SAME: Hard, multicolored, highly plastic  | СН            | Auger refusal                        |  |  |
|               |                           |              |        | <ul> <li>CLAY with silt and fine sand with -<br/>shale fragments at base</li> </ul> |               | Bottom of boring<br>26 ft -          |  |  |
|               |                           |              |        | -   | 1             | 26 ft -                              |  |  |
| _             |                           | !            |        |   |               | -                                    |  |  |
| -             |                           |              |        | -   | -             | -                                    |  |  |
|               |                           |              |        | <del></del>   | $\{$          | -                                    |  |  |
| -             |                           |              |        |   | 4             | _                                    |  |  |
|               |                           |              |        | wo -  |               |                                      |  |  |
|               |                           |              |        |   |               |                                      |  |  |
|               |                           | ,            |        |   |               |                                      |  |  |
|               |                           |              |        | <del>-</del>  | ]             |                                      |  |  |
|               |                           |              |        | <del>-</del>  |               |                                      |  |  |
| -             |                           |              |        | ·-  | 1             | -                                    |  |  |
| . –           |                           |              | 1      |   | -             | -                                    |  |  |
|               |                           |              |        |   | $\frac{1}{2}$ | -                                    |  |  |
|               |                           |              |        |   |               | _                                    |  |  |
|               |                           |              |        |   |               |                                      |  |  |
|               |                           |              |        | _   |               |                                      |  |  |
|               |                           |              |        |   |               |                                      |  |  |
|               |                           |              |        | -   |               |                                      |  |  |
|               |                           |              |        | <del>-</del><br>·   |               |                                      |  |  |
|               |                           |              |        | -<br>-  |               | -                                    |  |  |
|               |                           |              |        | <del></del>   | -             | _                                    |  |  |
|               | }                         |              |        | _ ·   | }             | -                                    |  |  |
| 4             | Ì                         |              |        |   | -             |                                      |  |  |
|               |                           |              |        |   |               |                                      |  |  |
|               |                           |              |        |   |               |                                      |  |  |
|               |                           |              |        |   | L             |                                      |  |  |
|               |                           |              |        | WOODWARD-CLYDE CONSULTANTS  |               | FIGURE NO. A-14                      |  |  |

| PROJECT I | NAME      | ORTHO CHEVRON           | · ·                                       | PROJECT NO. | S81-5              |
|-----------|-----------|-------------------------|---|-------------|--------------------|
| В         | -208      | PROJECT LOCATION        | ST. LOUIS, MISSOURI                       | DATE        | 1/29/81<br>CME 750 |
| SURFACE   | ELEVATION | LOGGED BY PETER BAFFETT | DRILLED BY G. Johanning ON DATUM USC & GS | WATER ENTE  | ERS E1 523 ATD     |

| DEPTH     |      | AMPLE  |  | <u> </u>     | DESCRIPTION  | T <sub>11</sub> | s.c. | SPECIAL NOTES AND           |            |
|-----------|------|--|--|--------------|--|-----------------|------|-----------------------------|------------|
| 0         | TYPE | REC  | RESIST   | —            |  |                 |      | FIELD OBSERVATIONS          |            |
| ļ         |      |  |  | <u> </u>     | Railroad ballast<br>Loose, black, cinder FILL  | F1              |      | Boring advanced with 6-inch |            |
|           | С    | _6   | Р  |              | Loose, Didok, Cilidel FIEL   |                 | ŀ    | diameter hollow             | 一丁         |
|           |      | 18   |  | -            | Brown, low plastic, clayey Silt FILL   | 4               | ł    | stem auger                  |            |
|           |      |  | -  | 1            |  |                 | 1    |                             |            |
|           | Ċ    | 12   | Р  | Τ            |  | 7               |      |                             |            |
| _         |      | 18   |  | L            | Becoming gray  | 4               |      |                             | 4          |
| 5         |      |  |  | 1            | 5 5 ,  | ļ               |      |                             |            |
|           | С    | 10   | Р  | $\Box$       |  |                 |      |                             |            |
| _         |      | 18   |  | -            | Becoming brown   | 4               |      |                             | -          |
|           |      |  |  | <b>!</b>     |  |                 |      |                             |            |
|           | С    | 12   | Р  | T            | Stiff, gray, low plastic, very Silty   | ٦c              | ;L   | Stream deposit              |            |
| 4         |      | 18   | }  | F            | CLAY   | 4               |      |                             | 4          |
|           |      | <del>                                     </del> | <del>                                     </del> | 1            |  |                 |      |                             |            |
| _         |      |  |  |              |  | 7               |      |                             |            |
| 10        |      | 10   |  | <u> </u>     |  |                 |      | ATD                         |            |
|           | С    | 18<br>18   | P  |              | Becoming brown with black organics,  |                 |      |                             |            |
| _         |      |  |  |              | root holes, etc.   | 7               | ľ    |                             | 7          |
| _         |      |  | ·  | L            |  | 4               | ŀ    |                             |            |
|           |      |  |  |              |  | 1               | ŀ    | •                           |            |
| _         |      |  |  |              | The state of the s |                 | - [  | •                           |            |
|           |      |  |  | L            |  | 4               | İ    |                             |            |
| 15        |      |  | į  |              |  | }               |      |                             |            |
|           | C    | 18   | Р  | <del> </del> | Brown Silty CLAY   | $\neg$          | .    | Modified loess              | $\neg$     |
| _         |      | 18   | ĺ  | L            | BIOWIN STITES CENT   | 4               | ŀ    | Tiod Fred Toess             |            |
|           |      |  | <b></b>  | ł            |  |                 |      |                             |            |
| -         |      |  |  | H            |  | 4               |      |                             | -          |
|           |      |  |  | L            |  |                 | ļ    |                             |            |
|           |      |  |  |              |  |                 | ļ    |                             |            |
| +         |      |  |  | H            |  | -               |      |                             | ᅥ          |
| 20        |      |  |  |              |  |                 |      |                             |            |
|           | С    | 18<br>18   | Р  | -            | Becoming more plastic  |                 |      |                             |            |
| 4         |      | 10   |  | H            |  | $\dashv$        |      |                             | 4          |
| _ [       |      |  |  | L            | •  |                 |      |                             | _1         |
| 7         |      |  |  | Γ            |  | 7               |      |                             | ٦          |
| 4         |      |  |  | -            |  | 4               |      |                             | -          |
| ı         | ļ    |  |  | L            |  |                 | -    |                             | !          |
| 25        | Į    |  |  |              | Becoming very stiff  | 7               |      |                             | ٦          |
| <b>47</b> | i    |  |  | <u> </u>     |  |                 |      | <del> </del>                |            |
|           |      |  |  |              | WOODWARD-CLYDE CONSULTANTS   |                 | 1    | FIGURE NO. A-               | <u> 15</u> |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5       |
|-------------------|---|-------------------------|
|                   |   | DATE 1/29/81            |
| B-208             | PROJECT LOCATIONST. LOUIS, MISSOURI             | RIG CME 750             |
|                   | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS ET 523 ATD |
| SURFACE ELEVATION | 533 FLEVATION DATUM USC & GS                    |                         |

| EPTH             | S    | AMPLE    |        | 1        | DECORUBITION  |             | SPECIAL NOTES AND         |
|------------------|------|----------|--------|----------|---|-------------|---------------------------|
|                  | TYPE | REC      | RESIST | 1        | DESCRIPTION   | U. S. C.    | FIELD OBSERVATIONS        |
| 25 <b>-</b><br>- | С    | 18<br>18 | Р      |          | Very stiff, brown with gray, highly plastic CLAY                      | СН          | Residual                  |
| _                |      |          |        | -        | _   |             |                           |
| -                |      |          |        | -        |   |             |                           |
| -<br>30          |      |          |        |          |   | CH-         |                           |
|                  | С    | 17<br>17 | P      |          | Hard, gray with brown mottling, shaley CLAY to weathered Clayey SHALE | SH          |                           |
| 1                |      |          |        |          |   |             |                           |
| -                | :    |          |        | _        | <del>-</del>  |             |                           |
|                  |      |          |        | -        | ·   |             | Auger refusal             |
| 35               | n    |          |        | _        | LIMESTONE   | LS          | Bottom of Boring<br>35 ft |
|                  |      |          | ]<br>  |          |   |             | 35 11                     |
| 1                |      |          | ]<br>  | _        | <u>-</u>  |             |                           |
| _                |      |          |        | -        | <u> </u>  |             |                           |
|                  |      |          |        | <u> </u> |   |             | -<br>-                    |
|                  |      |          | !<br>! |          |   |             |                           |
| 4                |      |          |        | _        | · -   |             |                           |
| $\exists$        |      |          |        | -        | . —   |             |                           |
| $\dashv$         |      |          |        |          |   |             | •                         |
|                  |      |          |        |          |   |             | ·                         |
| 4                |      |          |        |          |   |             |                           |
| 4                |      |          |        | _        | -   |             |                           |
| 一                |      |          |        |          | WOODWARD-CLYDE CONSULTANTS  | <del></del> | FIGURE NO. A-16           |

| PROJECT NAME      | ORTHO CHEVRON         |                            | PROJECT NO. S81-5          |
|-------------------|-----------------------|----------------------------|----------------------------|
| B-209             | PROJECT LOCATION      | ST. LOUIS, MISSOURI        | DATE 2/2/81<br>RIG CME 750 |
| CUREACE ELEVATION | LOGGED BY Peter Barre | tt DRILLED BY G. Johanning | WATER ENTERS EL 522 ATT    |

| EPTH   |          | AMPLE           |        | DESCRIPTION   | U. S. C. | SPECIAL NOTES AND              |
|--------|----------|-----------------|--------|---|----------|--------------------------------|
| 0 -    |          |                 | RESIST | DESCRIPTION   | 0.5.0.   | FIELD OBSERVATIONS             |
| ٦      |          |                 |        | Ballast, loose gravel and cinder FILL                                   | FILL     | with 6-inch<br>diameter hollow |
| 1      | С        | 10<br>18        | Р      | Stiff, gray, silty Clay FILL with organics and rock fragments           | 7        | stem auger<br>With odor        |
| 5      | С        | 14<br>18        | Р      |   |          | _                              |
|        | С        | 13              | P      | Stiff, brown and gray, low plastic - Silty CLAY with organics           | CL       | Stream deposit                 |
|        |          | 13<br>18        |        | - Without organics  |          | With root holes, iron stains   |
| 7      | С        | <u>14</u><br>18 | Р      | Becoming gray with brown, more silty                                    |          | Modified loess                 |
| 10     | С        | 14<br>18        | Р      | Firm to stiff, gray, low plastic SiltyCLAY                              | _        | -                              |
| 7      |          | 10              |        | _   |          |                                |
|        | ,        |                 |        | _   | -        | <u>;</u> ;                     |
| 15     |          |                 |        | Becoming brown-gray   | _        | -                              |
| -      | С        | 14<br>18        | P      | <del>_</del>  | -        |                                |
| -      |          |                 |        | Very stiff, brown-tan-brown, highly plastic CLAY with trace silt, black | CH       | Transitional to residual       |
| 20     |          |                 |        | deposits  |          | _                              |
| -      | С        | 10<br>18        | Р      | <del>-</del>  |          |                                |
| 4      |          |                 |        | _   |          |                                |
| -<br>- |          |                 |        | Stiff, light brown, low to medium plastic<br>Silty CLAY                 | c CL     |                                |
| 25     | <u>.</u> |                 |        |   |          |                                |

|      | ECT NAM<br>B-209 |          | _      | ORTHO CHEVRON  ST. LOUIS, MISSOURI  OGED BY Peter Barrett DRILLED BY G. Johanning | PR DA    | EET 2 OF 2  OJECT NO S81-5  TE 2/2/81  G CME 750  ATER ENTERS E1 522 ATC |
|------|------------------|----------|--------|---|----------|--|
| SURF | ACE ELE          | VATION   |        | O ELEVATION DATUM USC & GS  |          |  |
| DEPT | H S              | REC      | RESIST | DESCRIPTION   | U. S. C. | SPECIAL NOTES AND FIELD OBSERVATIONS                                     |
| 25   | C                | 16<br>15 | Р      | SAME: Stiff, light-brown, low to medium plastic, Silty CLAY                       | CL       | _  |
|      | -                |          |        | -   | -        | · _  |
|      | ]                |          |        | Hard, varicolored, highly plastic CLAY  | СН       | Residual -   |
| 30 _ |                  |          |        | <del></del>   |          |  |
|      |                  | 11<br>18 | Р      | -   | -        | ·  |
|      | -                |          |        | _   | 4        | -  |
|      | -                |          |        | <b>-</b>  | +        | _  |
| 35   |                  |          |        | <del>-</del>  | _        | Auger refusal —  |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5           |
|-------------------|---|-----------------------------|
| B-210             | ST. LOUIS, MISSOURI                             | DATE 1/30/81<br>RIG CME 750 |
| B 210             | LOGGED BY Peter Barrett DRILLED BY G. Johanning |                             |
| SURFACE ELEVATION | 529 FLEVATION DATUM USC & GS                    |                             |

| DEPTH            | 5000        | AMPLE            | India-       | Γ            | DESCRIPTION                                      | Τυ | J. S. C. | SPECIAL NOTES A                  |     |
|------------------|-------------|------------------|--------------|--------------|--|----|----------|----------------------------------|-----|
| 0 -              | TYPE        | REC              | RESIST       | <del> </del> | Loose ballast and Cinder FILL                    | 4  | ILL      | FIELD OBSERVATION                |     |
| <u> </u>         |             |                  |              | L            | 20050 Barrast and Ornaci Tree                    | ľ  | ILL      | Boring advanced with 6-inch diam |     |
|                  |             |                  |              | Γ            |  | 7  |          | eter hollow ster                 |     |
| -                |             |                  |              | <u> </u>     |  | 4  |          | auger                            | _   |
|                  | С           | 12               | P            | İ            | Stiff, black, organic, silty CLAY FILL           | ١  | ,        | With odor                        |     |
| -                | ١ ١         | 13<br>18         |              |              |  | ٦  |          |                                  |     |
| -                |             |                  |              | L            |  | 4  |          |                                  | _   |
| 5                | С           | 14<br>18         | Р            |              |  |    |          |                                  |     |
|                  |             |                  |              |              | <del>-</del>                                     | 7  |          |                                  |     |
| -                |             |                  | <del> </del> | ļ.           |  | 4  |          |                                  | _   |
|                  | С           | 14<br>18         | Р            |              |  | ١  |          |                                  | :   |
| -                |             | 10               |              | <b>–</b>     |  | ┪  |          |                                  | -   |
| _                |             |                  |              | L            |  | _  |          |                                  |     |
|                  | C           | 14<br>18         | P            | <b> </b>     |  | +  |          |                                  |     |
| -                | 1           | '                |              | -            | Stiff, black, gray and brown, organic Silty CLAY |    | CL-      | Stream deposit                   | -   |
| 10               |             |                  |              | L            | STILY CLAT                                       |    | 0 L      |                                  |     |
|                  | С           | 14<br>18         | Р            |              | Stiff brown Silty CLAV                           | +  |          | 4                                |     |
| -                | 1           | 10               |              | ┝            | Stiff, brown, Silty CLAY, organically stained    | 4  | CL       | <b>◆</b> ATD                     | _   |
|                  | <del></del> |                  |              | l            |  |    |          |                                  |     |
| -                | 1           |                  |              |              | •  | 7  |          |                                  |     |
| -                |             |                  |              | ļ_           |  | 4  |          |                                  | _   |
|                  |             |                  |              |              |  |    |          |                                  |     |
| -                | 1           |                  | ]            |              |  | ┪  |          |                                  | -   |
| 15               |             |                  |              | L_           | _  | 4  |          |                                  |     |
|                  | C           | 1 <u>3</u><br>18 | Р            |              |  | ł  |          |                                  |     |
| -                |             | 10               |              | <b>-</b>     |  | 1  |          |                                  |     |
| _                |             |                  |              | L            |  |    |          |                                  |     |
|                  |             |                  |              |              |  |    |          |                                  |     |
| -                |             |                  |              | H            |  | 4  |          | ·                                |     |
|                  |             |                  |              |              | Firm, black, organic, Silty CLAY with            | J  | OL-      |                                  |     |
| 20               |             |                  |              |              | vegetation                                       |    | CL       |                                  |     |
| <b> </b> ~       | С           | 15               | P            |              |  | 4  |          |                                  |     |
|                  |             | 15<br>18         | 1            |              |  |    |          |                                  |     |
| 7                |             |                  |              | _            |  | 7  |          |                                  | ٦   |
| ] _              |             |                  |              | _            |  | _  |          |                                  | _   |
|                  |             |                  |              |              |  |    |          |                                  |     |
| -                |             |                  |              | -            |  | 4  |          |                                  | -   |
| ل ا              |             |                  |              | _            | _  |    |          |                                  | ل   |
| 25               |             |                  |              | -            | •  |    |          |                                  | 7   |
| [ <sup>*</sup> ] |             |                  |              | <del></del>  |  |    |          |                                  | i   |
|                  |             |                  |              |              | WOODWARD-CLYDE CONSULTANTS                       |    |          | FIGURE NOA                       | -19 |

| PROJECT NAME        | ORTHO CHEVRON                                   | PROJECT NO. S81-5           |
|---------------------|---|-----------------------------|
| B-210               | PROJECT LOCATIONST. LOUIS, MISSOURI             | DATE 1/30/81<br>RIG CME 750 |
| SURFACE ELEVATION _ | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS ET 519 ATD     |

| DEPTH    | S    | AMPLE    |        | DESCRIPTION   | u. s. c         | SPECIAL NOTES AND  |
|----------|------|----------|--------|---|-----------------|--------------------|
| 25 -     | TYPE | REC      | RESIST | DESCRIPTION   |                 | FIELD OBSERVATIONS |
| 2)       | С    | 14<br>18 | Р      | SAME: Firm, gray, organic Silty CLAY<br>-                 | _ CL            |                    |
| -        |      |          |        | <del>-</del>  |                 | Some odor          |
| -<br>30_ |      |          |        |   |                 |                    |
|          | С    | 14 18    | Р      | Very stiff, greenish-gray, Silty CLAY<br>— with fine sand | CL<br>-w/<br>SM | -                  |
| -        |      |          |        | <del>-</del>  | 1               | -                  |
| 35       |      |          |        | <del>-</del>  | 1               | _                  |
|          |      |          |        |   |                 | -                  |
| 4        |      |          |        | Stiff, reddish-brown, highly plastic                      | СН              | Residual -         |
| 40_      |      |          |        | CLAY with limestone fragments                             |                 | Bottom of Boring   |
| -        |      |          |        | <del>-</del>  |                 | 40 ft -            |
|          |      |          |        | _   |                 | -                  |
| 45       |      |          |        |   | _               |                    |
| 4        |      |          |        | -<br>-  | 1               | -                  |
| 4        |      |          |        | _<br>_  | -               | -                  |
|          |      |          |        | WOODWARD-CLYDE CONSULTANTS                                |                 | FIGURE NO. A-20    |

|                   |       |                  |              | BORING LOG                                    | <b>SH</b>    | EET 1 OF 2                               |
|-------------------|-------|------------------|--------------|---|--------------|--|
| PROJEC            | T NAM | E                |              | ORTHO CHEVRON                                 |              | ROJECT NO. 581-5                         |
| B-211             |       |                  | PF           | OJECT LOCATIONST. LOUIS, MISSOURI             | D#           | 1/29/81<br>G CME 750                     |
| <u> </u>          |       |                  | — ∟          | GGED BY Peter Barrett DRILLED BY G. Johanning |              | ATER ENTERSET 526                        |
| SURFAC            | E ELE | VATION           | 52           | ELEVATION DATUM USC & GS                      |              |  |
| DEPTH             |       | AMPLE            | 1550.00      | DESCRIPTION                                   | U.S.C.       | SPECIAL NOTES AND                        |
| 0 -               | TYPE  | REC              | RESIST       | Loose, black, cinder FILL                     | FILL         | FIELD OBSERVATIONS  Boring advanced with |
|                   |       | <u> </u>         |              | Loose, brack, critical Fill                   | <b>J</b> ''' | 6-inch diameter _                        |
|                   | С     | 14<br>18         | Р            |   |              | hollow stem auger                        |
| 1                 |       |                  |              | Stiff, gray-green Clay FILL with bricks       |              | ATD                                      |
| -                 | С     | 13               | P            | and organics                                  | 4            | With odor -                              |
|                   | _     | 1 <u>3</u><br>18 | }            |   |              | _  |
| 5                 |       | <b> </b>         | <del> </del> |   |              |  |
| $\Gamma = \Gamma$ | С     | <u>6</u><br>18   | Р            | Becoming gray-black                           | 7            |  |
| -                 |       | 18               |              |   | -            | -  |
|                   |       |                  |              |   | -CL          | Stroom donosit                           |
|                   | С     | 10<br>18         | Р            | Stiff, gray, Silty CLAY with brown            | - CL         | Stream deposit -                         |
| -                 |       | 10               |              | organics                                      | 7            | -  |
|                   |       |                  |              |   | 4            | _  |
| 10                |       |                  |              |   |              |  |
| '                 | С     | <u>10</u>        | Р            | <u> </u>                                      |              |  |
| -                 |       | 18               |              | -   | -            | · -                                      |
|                   |       | <del> </del>     |              | _   |              |  |
|                   |       | İ                | Ì            |   |              |  |
| -                 |       |                  |              | <del>-</del>                                  | 7            | <del>-</del>                             |
|                   |       |                  |              | -   | 4            |  |
| 15                |       |                  |              |   |              | ·  |
| '                 | С     | 18<br>18         | Р            | Becoming more brown with small black          |              | _  |
| -{                |       | 10               |              | - organics                                    | 4            | _  |
|                   |       |                  |              | _   | 4            | _  |
|                   |       |                  |              |   |              |  |
|                   |       |                  |              |   | 7            |  |
| -                 |       |                  |              |   | СН           | <br>Residual                             |
| 20_               |       |                  |              | Very stiff, brown, highly plastic CLAY        |              | kesiduai -                               |
|                   | С     | 18               | Р            |   |              |  |
| -[                |       | 18               |              | <del> -</del>                                 | 4            | -  |
| │                 |       |                  |              | <u></u>                                       | 4            | -  |
|                   |       |                  |              |   |              |  |
| ٦                 |       |                  |              | F   | 7            | -  |
| <u>,</u>          | İ     |                  |              | <del> -</del>                                 | 4            | -  |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAME      | ORTHO CHEVRON                                  | PROJECT NO. S81-5        |
|-------------------|--|--------------------------|
| B-211             | PROJECT LOCATION ST. LOUIS, MISSOURI           | DATE 1/29/81 RIG CME 750 |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johannii |                          |

| DEPTH | s    | AMPLE    |        | DESCRIPTION   | U. S. C. | SPECIAL NOTES AND           |
|-------|------|----------|--------|---|----------|-----------------------------|
| 25 -  | TYPE |          | RESIST |   | 1        | FIELD OBSERVATIONS          |
| -     | С    | 18<br>18 | Р      | SAME: Very stiff, gray-brown, highly<br>plastic CLAY with orange mottling . | СН       | _                           |
| _     |      |          | _      | -   |          | _                           |
| -     |      |          |        | <u>-</u>  | -        | -                           |
| 30    |      | 2.43     |        | <del>-</del>  |          |                             |
| _     | S    | 3/6      | 30_    | SANDSTONE: Fine to medium grained, moderately cemented                      | SS       | Bottom of Boring<br>30.5 ft |
| _     |      | i        |        | <del>-</del> .  |          | -                           |
|       |      |          | i      | <b>-</b><br>-   |          | _                           |
| 35    |      |          |        | <br>  |          | _                           |
| -     |      |          |        | -<br>-  | <u> </u> | ·                           |
| _     |      |          | :      |   | 1        | _                           |
| _     |      |          |        | -<br>-  |          | _                           |
|       |      |          |        |   |          |                             |
| -     |      |          |        | - · · · · ·   |          | · _                         |
| _     |      |          |        | -   |          | -                           |
| -     |      |          |        | -   |          | -                           |
| _     |      | i        |        | -<br>   |          | _                           |
| 4     |      |          |        |   |          |                             |
| _     |      | S        |        | -   |          | . 4                         |
| _     |      |          | }      | -   |          | -                           |
|       |      |          |        | <u> </u>  |          | -                           |
|       |      |          |        | WOODWARD-CLYDE CONSULTANTS  |          | FIGURE NO. A-22             |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5        |
|-------------------|---|--------------------------|
| B-212             | ST. LOUIS, MISSOURI                             | DATE 2/24/81 RIG CME 750 |
|                   | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS E1 494 ATE  |
| SURFACE ELEVATION | 514 ELEVATION DATUM USC & GS                    |                          |

| DEPTH |      | AMPLE     |        | DESCRIPTION  | u.s.c.                     | SPECIAL NOTES AND                              |
|-------|------|-----------|--------|--|----------------------------|--|
| 0     | TYPE | REC       | RESIST | DESCRIPTION  | 1                          | FIELD OBSERVATIONS                             |
| 1     |      | ı         |        | Firm, black, silty Clay FILL with organics and rock fragments (Ramp to center of pond) | FILL                       | with 6-inch diam-<br>eter hollow stem<br>auger |
|       | С    | 10<br>18  | Р      | Firm to stiff, dark gray, low plastic<br>CLAY with organics                            | CL                         | Stream deposit<br>With odor                    |
| 5     | С    | 12<br>18  | Р      | <br>-  |                            | \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \          |
| _     | Ċ    | 11<br>18  | P      | Without organics, medium plastic   |                            |  |
| 10    |      |           |        | _<br>_<br>   | -                          |  |
| -     | С    | 12<br>18  | P      | Becoming low plastic   | _                          |  |
| -     | С    | 15<br>18  | Р      | -<br>-   | }                          | Slight odor                                    |
| -     |      |           |        | Firm to stiff brown low plastic  | CL                         |  |
| 15    | С    | 14<br>18  | Р      | Firm to stiff, brown, low plastic Silty CLAY -   | -<br>-<br>-                | Modified loess                                 |
| -     |      |           |        | -  | -                          | _  |
| -     |      |           |        |  | -<br>-<br>-<br>-<br>-<br>- |  |
| 20    | С    | <u>15</u> | P      | Becoming medium to highly plastic  Stiff to hard, tan-brown, highly plastic            | CH<br>CH                   | <b>←</b> ATD — Residual                        |
| -     |      | 18        |        | CLAY with trace silt and iron deposits   |                            | Bottom of Boring<br>21.5 ft                    |
| -     |      |           |        |  |                            |  |
| 25    | ·    |           |        | WOODWARD-CLYDE CONSULTANTS   | <u></u>                    | FIGURE NO. A-23                                |

| PROJEC | CT NAM | IE   |        | OR                                   | THO CHEVRON   |   |           | EET OF<br>ROJECT NO S81-5                                    |
|--------|--------|--|--------|--------------------------------------|---|---|-----------|--|
| B-213  |        |  |        | PROJECT LOCATION ST. LOUIS, MISSOURI |   |   |           | TE 1/26/81  CME 750  |
| SURFAC | CE ELE | EVATION  |        |                                      | D BY Peter Barrett DRILLED BY G. Johanning ELEVATION DATUM USC & GS | 9 | _         | ATER ENTERSEL 498 ATD 505 24 hr AD                           |
| DEPTH  | TYPE   | REC  | RESIST | Γ                                    | DESCRIPTION   |   | U. S. C.  | SPECIAL NOTES AND FIELD OBSERVATIONS                         |
| 0 -    | С      | 2<br>18  | P      |                                      | Stiff, brown, low to medium plastic silty Clay FILL                 | _ | FILL      | Boring advanced with 6-inch diam- — eter hollow stem auger — |
|        |        | <del>                                     </del> |        | <u>F</u> .                           | Stiff, light gray, Silty CLAY                                       |   | CL        | Stream deposit   |
| -      | С      | 3<br>18  | Р      | <u> </u>                             | Still, light glay, Slity CEAL                                       | _ | ,         | Organically stained  |
| 5      | C      | <u>3</u><br>18                                   | P      | -                                    | Becoming dark gray-brown  |   |           |  |
| -      |        |  |        | _                                    |   | - |           | ▼ 24 hrs AD  |
| 10     |        |  |        |                                      | Stiff, brown, low to medium plastic<br>Silty CLAY                   |   |           | Modified loess   |
| _      | С      | 3<br>18  | Р      | _                                    |   | _ |           |  |
| -      |        |  |        | -                                    |   |   |           | -  |
| 15     |        |  |        | _                                    | Very stiff brown, highly plastic<br>Silty CLAY                      |   | СН        | ATD  |
| -      | С      | 8 18   | Р      | _                                    |   |   |           | Residual -   |
| -      |        |  |        |                                      |   | _ |           | -  |
| _      |        |  |        | -                                    |   | _ |           | ·  |
| 20     | C      | 8<br>18  |        |                                      |   |   |           |  |
|        |        |  |        | _                                    | Very stiff, purple, highly plastic CLAY with shaley zones           | _ | CH-<br>SH | -  |
| -      |        |  |        | 1                                    |   |   |           | -  |
| 25     |        | f  |        |                                      |   |   |           |  |

WOODWARD-CLYDE CONSULTANTS

|                   |                     |                     | SHEETUF                   |
|-------------------|---------------------|---------------------|---------------------------|
| PROJECT NAME      | ORTHO CHEVRON       |                     | PROJECT NO. <u>\$81-5</u> |
|                   |                     |                     | DATE 1/26/81              |
| B-213             | PROJECT LOCATIONST. | LOUIS, MISSOURI     | RIG CME 750               |
| <u></u>           |                     | ST. LOUIS, MISSOURI | WATER ENTERS E1 498 ATD   |
| SURFACE ELEVATION | 513 ELEVATION       | DATUM USC & GS      | El 505 24 hrs AD          |

|               | CE ELE   |         |          | ELEVATION DATUM 030 8 43                                   |     |           | 1 303 24 III'S AD                    |
|---------------|----------|---------|----------|--|-----|-----------|--------------------------------------|
| DEPTH<br>25 - | TYPE     |         | RESIST   | DESCRIPTION  |     | U. S. C.  | SPECIAL NOTES AND FIELD OBSERVATIONS |
|               | С        | 6<br>18 | Р        | SAME: Very stiff, highly plastic CLAY with shale fragments | -   | CH-<br>SH |                                      |
|               | <b> </b> |         | <u> </u> | LIMESTONE: Weathered                                       |     | LS        | Auger refusal                        |
| -             | 1        |         |          | -  | -   |           | Bottom of Boring -<br>26.11          |
| -             | İ        |         |          | _  | _   | ļ         | 20.11                                |
| _             |          |         |          | ·<br>_   | _   |           |                                      |
|               | 1        |         |          | <del>-</del>   |     | ]         |                                      |
| 30            | ĺ        |         |          | ·  |     |           | · -                                  |
| -             |          |         | }        | -  | _   | ł         | _                                    |
|               |          |         | Ì        | _  | _   | 1         |                                      |
|               |          |         |          |  |     | ]         | ·                                    |
| -             | 1        | Ì       |          | -  | -   | i         |                                      |
| -             |          | Ī       | ł        | _  | _   |           | _                                    |
| <u> </u>      |          |         |          |  |     |           |                                      |
|               |          |         |          | <del></del>  |     | ]         |                                      |
| -             | 1        |         |          | -  |     |           | · -                                  |
| ] _           |          |         |          | _  |     |           | _                                    |
|               |          |         |          |  |     | 1         |                                      |
| -             | ]        |         |          | -  | . – | 1         | _                                    |
| -             |          |         |          | -  | _   |           | -                                    |
| l _           |          |         |          | _  |     | 1         | · .                                  |
|               |          |         |          |  |     |           | ·                                    |
|               |          |         |          | -  | _   | l         | 7                                    |
| -             |          |         |          | -  | -   |           | -                                    |
|               |          |         |          | -  |     |           |                                      |
|               | i        |         |          |  |     |           |                                      |
|               |          |         |          | -  | -   |           |                                      |
| -             |          |         |          |  |     |           |                                      |
|               |          |         |          | _  |     |           |                                      |
|               |          |         | <u>'</u> |  |     |           | ٦                                    |
|               |          |         |          | -  |     |           | 4                                    |
| -             |          |         |          | _  | 4   |           | _                                    |
|               |          | ļ       |          | _  |     |           |                                      |
| 7             |          |         |          | <del>-</del>   |     |           | 7                                    |
|               |          |         |          | WOODWARD-CLYDE CONSULTANTS                                 |     |           | FIGURE NO 4 25                       |
|               |          |         |          | MOODMWUD.OFIRE FAUSATIWEIS                                 |     |           | FIGURE NO. A-25                      |

|              |       |          |           |              | BOTTITIO EGG   | - CU             | EET1OF2   |
|--------------|-------|----------|-----------|--------------|--|------------------|---|
| PROJECT NAME |       |          | OR        | THO CHEVRON  |  | ROJECT NO. S81-5 |   |
| B-214        |       |          | PR        | OJEC         | ST. LOUIS, MISSOURI BY Peter Barrett DRILLED BY G. Johanning             | _ RI             | TE 1/30/81  G CME 750  ATER ENTERS E1 530 ATD   |
| SURFAC       | E ELE | VATION   |           |              | ELEVATION DATUM USC & GS   |                  |   |
| DEPTH        | 5V06  | AMPLE    | RESIST    | Γ            | DESCRIPTION  | U. S. C.         | SPECIAL NOTES AND                               |
| 0 -          | ITPE  | REC      | I KESIS I | -            | Loose, cinder FILL   | FILL             | FIELD OBSERVATIONS  Boring advanced             |
|              |       |          |           |              | Stiff, gray, clayey Silt FILL with cinder                                | s                | with 6-inch diam<br>eter hollow stem<br>auger - |
|              | С     | 16<br>18 | P         | -            |  | -                | With odor                                       |
| -            | С     | 12       | P         | -            | Becoming brown and high plastic Stiff, gray, low plastic Silty CLAY with | CL               | ATD _   |
| 5            |       | 18       |           | -            | organics —   | -                | ·. —  |
|              | С     | 13<br>18 | Р         | -            |  | 7                | -   |
|              |       | 18       |           | }            |  | 1                | Pond deposit _                                  |
|              | С     | 14<br>18 | Р         | _            | Stiff, brown, low plastic Silty CLAY                                     |                  | Modified loess                                  |
| 10           |       |          |           |              | _  | _                |   |
|              | C     | 13<br>18 | Р         | _            |  | -                | _   |
|              |       |          |           | -            |  | -                | _   |
| -            |       |          |           | <b> </b>     |  | -                |   |
| -            |       |          |           | _            |  |                  |   |
| 15           |       | 15       | P         |              | Becoming low to medium plastic   | -                |   |
| -            |       | 15<br>18 |           | _            |  | -                |   |
| -            |       |          |           | _            |  | -                | _   |
| -            |       |          |           | -            |  | -                | -   |
| -            |       |          |           | _            | Becoming light gray and brown, medium                                    | -                | -   |
| 20           | C     | 14       | P         |              | plastic  | -                |   |
| _            |       | 18       | ·         | _            |  | _                | _   |
|              |       |          |           | _            |  | 4                | _   |
|              |       |          |           |              |  | <u> </u>         |   |
| 25           |       | !        |           | <del>-</del> | Very stiff, brown and gray, medium to highly plastic CLAY with silt      | CH CH            | -   |

WOODWARD-CLYDE CONSULTANTS

|                   | BORING LOG                                      |  |
|-------------------|---|--|
| PROJECT NAME      | ORTHO CHEVRON                                   | SHEET 2 OF 2<br>PROJECT NO. <u>S81-5</u> |
| B-214             | PROJECT LOCATIONST. LOUIS, MISSOURI             | DATE 1/30/81 RIG CME 750                 |
| CUREACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS E1 530 ATE                  |

| DEPTH |      | AMPLE       |        |   | <del>.</del> | SPECIAL NOTES AND           |
|-------|------|-------------|--------|---|--------------|-----------------------------|
|       | TYPE | REC         | RESIST | DESCRIPTION   | u.s.c.       | FIELD OBSERVATIONS          |
| 25 -  | С    | 14<br>18    | Р      | SAME: Very stiff, brown and gray medium to highly plastic CLAY with trace | CL<br>I      | Residual                    |
|       |      |             |        | silt  | СН           |                             |
|       |      |             |        | _   |              |                             |
|       |      |             |        | _   |              |                             |
| 30    |      |             |        |   | }            |                             |
|       |      |             |        |   |              |                             |
|       |      |             |        |   |              |                             |
|       |      |             |        |   |              |                             |
|       |      |             |        |   | }            |                             |
| 35    |      |             |        |   |              | _                           |
|       |      |             | :      | <del></del>   |              |                             |
|       |      |             |        |   |              |                             |
|       |      |             |        | _   |              |                             |
|       |      |             |        |   |              | ].                          |
| 40    |      |             |        | · ·   |              |                             |
|       | i    |             |        | LIMESTONE   | LS           | Bottom of Boring<br>40 ft — |
|       |      |             |        | -<br>-  |              | 10 12                       |
|       |      |             |        | <del>-</del>  |              |                             |
|       |      |             |        | <del>-</del>  |              |                             |
| 45    | ,    |             |        |   |              |                             |
|       |      |             |        |   |              |                             |
|       |      |             |        | <b>-</b>  |              |                             |
|       |      | ĺ           |        | -<br>-  |              |                             |
|       | .    |             | İ      | <b>-</b>  |              | _                           |
| -     |      |             |        | <del>-</del>  |              | _                           |
|       |      | <del></del> |        | WOODWARD-CLYDE CONSULTANTS  |              | FIGURE NO. A-27             |

| PROJECT NAME        | ORTHO CHEVRON  | PROJECT NO. S81-5                       |
|---------------------|--|---|
| B-215               | PROJECT LOCATION ST. LOUIS, MISSOURI   | DATE 3/2/81 RIG CME 750                 |
| SURFACE ELEVATION _ | LOGGED BY Peter Barrett DRILLED BY G. Johanning 523 ELEVATION DATUM USC & GS | WATER ENTERSET 513 ATD E1 516 24 hrs AD |

|       | E ELE  |                  |              |              | ELEVATION DATUM 536 5 43   |          |                                      |
|-------|--------|------------------|--------------|--------------|--|----------|--------------------------------------|
| DEPTH | TYPE S | AMPLE            | RESIST       |              | DESCRIPTION  | U.S.C    | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 0 -   |        |                  |              |              | Firm to stiff, brown, silty Clay FILL with organics                    | FILL     | <del></del>                          |
| _     | С      | 14<br>16         | Р            | _            | •<br>•   | 4        | eter hollow stem<br>auger            |
| -     | С      | 14               | P            | _            | -  |          | ·                                    |
| 5     |        | 16               |              | f            | -  |          |                                      |
|       | С      | 12<br>16         | Р            |              | Firm to stiff, brown, low to medium                                    | CL       | Modified loess                       |
| _     | С      | - 14             | P            |              | plastic Silty CLAY   | -        | ▼ 24 hrs AD                          |
|       |        | 16               |              | +            | -  | 1        |                                      |
| 10    | С      | 1.5              | P            |              |  |          | ATD _                                |
| _     |        | 1 <u>5</u><br>16 | r<br>        | _            | -  |          |                                      |
| -     |        |                  |              | -            | -  |          |                                      |
|       |        | 1                | <u> </u><br> |              | -<br>-<br>-  |          |                                      |
| 15_   | С      | 14<br>16         | P            | -            | Becoming stiff, dark brown, medium plastic with black ferrous deposits | -        | -                                    |
| _     |        | 16               | <br>         | -            | <u>.</u>   | 1        |                                      |
| -     |        |                  |              |              | · · · · · · · · · · · · · · · · · · ·                                  |          |                                      |
|       |        |                  |              | _            | Stiff, dark brown, medium to highly                                    | СН       |                                      |
| 20    | С      | 14<br>18         | P            | <del> </del> | plastic CLAY   | 1        | Residual                             |
|       |        | 10               |              |              | •<br>•   |          |                                      |
|       |        |                  |              | <u> </u>     | -  |          |                                      |
| 25    |        |                  |              |              | Becoming shaley, with fine sand - Becoming hard                        | CH<br>SM |                                      |
|       |        |                  |              |              | WOODWARD-CLYDE CONSULTANTS   |          | EIGHDE NO A-28                       |

|                     |   | SHEETOF                 |
|---------------------|---|-------------------------|
| PROJECT NAME        | ORTHO CHEVRON                                   | PROJECT NO. S81-5       |
|                     | 7   | DATE 3/2/81             |
| B-215               | PROJECT LOCATION ST. LOUIS MISSOURI             | RIG CME 750             |
| <u> </u>            | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS El 513 ATD |
| SURFACE ELEVATION _ | 523 ELEVATION DATUM USC & GS                    | El 516 24 hrs AD        |

| DEPTH | •    | AMPLE |        |  |        | SPECIAL NOTES AND                    |
|-------|------|-------|--------|--|--------|--------------------------------------|
| 25 -  | TYPE | REC   | RESIST | DESCRIPTION  | U.S.C. | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 25    | С    | 7/12  | Р      | SAME: Hard, varicolored, Sandy SILT with trace highly plastic clay and shale fragments | ML     |                                      |
| _     |      |       |        | <u> </u>   |        |                                      |
| 30    |      |       |        | -<br>-   |        | _                                    |
| -     |      |       |        | LIMESTONE  | LS     | Auger refusal Bottom of Boring       |
| -     |      |       |        | -<br>-   |        | 31 ft _                              |
|       |      |       |        | -<br>-   |        |                                      |
| 35    |      |       |        | <del></del>  |        |                                      |
| _     |      |       |        |  |        | _                                    |
| -     |      |       |        | -  |        | .—                                   |
| -     |      |       |        |  |        | _                                    |
| -     |      |       | i      | <b>-</b><br>   |        |                                      |
|       |      |       |        |  |        | _                                    |
|       |      |       |        | - ·  |        | _                                    |
|       | !    |       |        | -  |        | <del>-</del>                         |
| _     |      |       |        |  |        | -                                    |
|       |      |       |        |  |        | _                                    |
|       |      |       |        | -<br>-   |        |                                      |
|       |      |       |        | -<br>-   |        | _                                    |
| -     |      |       |        | _  |        | -                                    |
|       |      |       |        | WOODWARD-CLYDE CONSULTANTS   |        | FIGURE NO. A-29                      |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5       |
|-------------------|---|-------------------------|
| PROJECT NAME      | OKT TIO CHEVRON                                 | DATE 2/23/81            |
| B-216             | PROJECT LOCATION ST. LOUIS, MISSOURI            | RIG CME 750             |
|                   | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS ET 512 ATE |
| SURFACE ELEVATION | 518 ELEVATION DATUM USC ε GS                    |                         |

| SURFAC | CE ELE    | VATION           |   | ELEVATION DATUM USC & GS                                    | <del></del>  |   |
|--------|-----------|------------------|---|---|--------------|---|
| DEPTH  | S<br>TYPE | AMPLE<br>REC     | RESIST  | DESCRIPTION   | u. s. c.     | SPECIAL NOTES AND FIELD OBSERVATIONS    |
| 0 -    |           |                  |   | Firm to stiff, brown silty Clay FILL with organic fragments | FILL         | with 6-inch diam- —<br>eter hollow stem |
|        | С         | 9<br>18          | Р   | <del>-</del><br>-   |              | auger                                   |
| 5 —    | С         | 12<br>18         | Р   | <del>-</del>  |              | -                                       |
|        | С         | 11<br>18         | Р   | Firm to stiff, gray Silty CLAY                              | - CL         | ← ATD  Stream deposit  Slight odor      |
| 10     | С         | 13<br>18         | Р   |   | <del>-</del> | -                                       |
|        | С         | 14<br>18         | Р   | with tall brown   |              | -                                       |
| 1 1    | С         | 14<br>18         | Р   | Firm to stiff, brown Silty CLAY with some gray              |              | Modified loess _                        |
| 15     | С         | 16<br>18         | Р   | <del>-</del><br>  |              |   |
|        |           | 10               |   | Becoming low to medium plastic                              | -            | _                                       |
| 20_    |           |                  |   | Stiff to hard, tan-brown highly plastic                     | СН           | Residual                                |
|        | С         | 1 <u>5</u><br>18 | Р   | CLAY with trace silt  |              | -                                       |
|        |           |                  |   | -<br>-<br>-   |              |   |
| 25     |           |                  | <u>,                                     </u> | WOODWARD-CLYDE CONSULTANTS                                  |              | FIGURE NO. A-30                         |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5           |
|-------------------|---|-----------------------------|
| B-216             | PROJECT LOCATIONST. LOUIS, MISSOURI             | DATE 2/23/81<br>RIG CME 750 |
| CUREACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS E1 512 ATD     |

| 25 TYPE REC RESIST  SAME: Stiff to hard, highly plastic CLAY CH  Becoming purple  LIMESTONE  SAME: Stiff to hard, highly plastic CLAY CH  Auger  LS Bottom | NOTES AND                      | SPECIAL NOT    | u.s.c. |                     | DESCRIPTION     |          | AMPLE      | SAMP    | DEPTH |
|--|--------------------------------|----------------|--------|---------------------|-----------------|----------|------------|---------|-------|
| SAME: Stiff to hard, highly plastic CLAY CH - Becoming purple - Auger - LIMESTONE - LS Bottom 26   | DBSERVATIONS                   | FIELD OBSER    |        |                     |                 | RESIST   | REC RESIST | TYPE RE |       |
| _ LIMESTONE _ LS Bottom 26   |                                |                | AY CH  | highly plastic CLAY |                 |          |            | ] [     | •     |
|  |                                | Auger refi     |        | •                   | Becoming purple | -        |            | 1       | -     |
|  | m of Boring <u> </u><br>6.5 ft | Bottom of 26.5 | LS     | -                   | LIMESTONE       | -        |            |         | -     |
|  | · -                            |                | 4      | -                   | -               | -        |            |         | -     |
|  |                                |                | 4      | -                   | -               | F        |            |         | -     |
|  | · ·                            |                |        |                     | <del></del>     |          |            |         | 30    |
|  | •                              |                | 1      | •                   | ·               |          |            |         | -     |
|  | -                              |                | -      | •                   | -               |          |            | 1 1     | _     |
|  | -                              |                | +      | •                   | -               | <b> </b> |            |         | -     |
|  | -                              |                |        | -                   | -               | -        |            |         | -     |
|  | _                              | -              | -      | -                   | <del></del>     | <u> </u> |            |         | -     |
|  | _                              |                | -      | -                   | -               | -        |            |         | _     |
|  |                                |                | -      | -                   | -               | -        |            |         | -     |
|  | _                              |                | 4      |                     | -               | -        |            |         | -     |
|  | _                              |                | 4      | -                   | -               | -        |            | 1       | -     |
|  |                                |                | -      |                     | <del></del>     | -        |            | 1       | -     |
|  |                                | ·              | -      | -                   | -               | -        |            | 1       | -     |
|  | _                              |                | 4      | -                   | -               | -        |            | 1       | -     |
|  | _                              |                | -      | •                   | _               | -        |            |         | -     |
|  | · <u>-</u>                     |                | 4      | -                   | -               | -        |            |         | _     |
|  | _                              |                | -      |                     |                 | <b>—</b> |            |         |       |
|  | -                              |                | 4      | -                   | -               | -        |            |         | -     |
|  |                                |                | 4      | -                   | -               | -        |            |         | -     |
| 1 1 1 1 1  |                                |                | 4      | -                   | -               |          |            |         | -     |
| ] -      -   -   -   -   -   -   -   -   |                                | l              | 4      | -                   | -               | L        | 1          |         |       |
|  | <del> </del>                   |                |        | = 4                 |                 |          |            |         |       |

WOODWARD-CLYDE CONSULTANTS

|            | B-21 | 7                | PF<br>LC | ORTHO CHEVRON  JECT LOCATION ST. LOUIS, MISSOURI  SED BY Peter Barrett DRILLED BY G. Johanning  6 ELEVATION DATUM USC & GS |                        | PR<br>DA<br>RI | EET 0F 2  OJECT NO. S81-5  TE 2/9/81  G CME 750  ATER ENTERS E1 501 ATE |
|------------|------|------------------|----------|--|------------------------|----------------|---|
| DEPTI<br>0 | H S  | SAMPLE<br>I REC  | RESIST   | DESCRIPTION  | L                      | J. S. C.       | SPECIAL NOTES AND FIELD OBSERVATIONS                                    |
|            |      |                  |          | Loose, black and dark red-brown Cinder<br>FILL   |                        | FILL           | Boring advanced with 6-inch diam- eter hollow stem auger -              |
|            |      | 10<br>18         | P        |  | 4                      |                | Strong odor   |
| 5 —        | C    | 7 18             | P        | Stiff, gray, low plastic Silty CLAY with organics  | 1                      | CL             | Stream deposit -  |
|            | С    | 11/18            | Р        | Becoming green-gray  | -                      |                | · <b>-</b>  |
|            |      |                  |          | Stiff, brown, low plastic Silty CLAY   |                        |                | Modified loess  |
| 10 _       |      |                  |          | ·<br><del>-</del>  |                        |                | . <u>-</u>  |
|            | °    | 1 <u>3</u><br>18 | P        | With some organics   | $\left  \cdot \right $ |                | _   |
|            |      |                  |          |  | 1                      |                |   |
| 15 _       |      |                  |          |  | -                      |                | ATD   |
| -          | С    | <u>11</u><br>18  | Р        | <del>-</del>   | -                      |                | — NID —   |
|            |      |                  |          |  |                        |                | _   |
| 20         |      |                  |          |  |                        |                | · <u>-</u>  |
| _          | С    | 10<br>18         | Р        | Hard, tan-brown, highly plastic CLAY with iron deposits  | -                      | СН             | Residual  |
| -          |      |                  |          |  | _                      |                | -   |
| _          | -    |                  |          | Becoming purple  | 4                      |                | _   |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAME      | ORTHO CHEVRON  | PROJECT NO. S81-5          |
|-------------------|--|----------------------------|
| B-217             | PROJECT LOCATION ST. LOUIS, MISSOURI   | DATE 2/9/81<br>RIG CME 750 |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning 516 FLEVATION DATUM USC & GS | WATER ENTERS ET 501 ATD    |

| DEPTH      |      | AMDIE |        |  |          | SPECIAL NOTES AND             |
|------------|------|-------|--------|--|----------|-------------------------------|
| 25 -       | TYPE | REC   | RESIST | DESCRIPTION                              | U. S. C. | FIELD OBSERVATIONS            |
|            |      |       |        | SAME: Hard, purple-brown, highly plastic | СН       |                               |
| -          |      |       |        | LIMESTONE                                | LS       | Bottom of Boring _<br>25.5 ft |
| <b>i</b> _ |      |       |        |  | -3       |                               |
|            |      |       |        |  |          |                               |
| -          |      |       |        | -  | 1        | <del>-</del>                  |
| _          |      |       |        | <del>_</del>                             |          | _                             |
| 30         |      |       |        |  |          |                               |
|            |      |       |        |  | 1        |                               |
| -          |      |       |        | <del>-</del>                             | 1        | _                             |
|            |      | !     |        | _  |          | _                             |
|            |      |       |        |  |          |                               |
| -          |      |       |        | <del>-</del>                             | 1        | · -                           |
|            |      |       |        |  |          | · -                           |
|            |      |       |        |  |          |                               |
|            |      |       |        | <del></del>                              | 1        |                               |
| -          |      |       |        | -  | 1        | -                             |
|            |      |       |        |  |          | _                             |
|            |      |       |        |  | ]        | _                             |
| -          |      |       |        | <del>-</del>                             |          | <del>-</del>                  |
|            |      |       |        | _  |          |                               |
|            |      |       |        |  |          |                               |
| _          |      |       |        | <del></del>                              | 1        |                               |
| _          |      |       |        |  |          | _                             |
|            |      |       |        |  |          |                               |
|            |      |       |        | <del>-</del>                             | 1        | _                             |
|            |      |       |        |  |          | _                             |
|            |      |       | ,      |  | ]        |                               |
| 7          |      |       |        | <del>-</del>                             | [        |                               |
| _          |      |       |        | <del></del>                              |          |                               |
|            |      |       |        | _  |          | _                             |
|            |      |       |        |  |          | _                             |
| -          | ļ    |       |        |  |          | -                             |
|            | [    |       |        |  |          | _                             |
| ]          | i    |       |        |  |          |                               |
| -          | ŀ    |       |        | <del>-</del>                             |          | <del></del>                   |
| $\dashv$   |      |       |        |  | L        |                               |
|            |      |       |        | WOODWARD-CLYDE CONSULTANTS               |          | FIGURE NO. A-33               |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5        |
|-------------------|---|--------------------------|
| B-218             | PROJECT LOCATION ST. LOUIS, MISSOURI            | DATE 2/23/81 RIG CME 750 |
|                   | LOGGED BY Peter Barrett DRILLED BY B. Johanning | WATER ENTERS EL 512 ATD  |
| SURFACE ELEVATION | 519 ELEVATION DATUM USC & GS                    |                          |

| DEPTH SAMPLE  O TYPE REC RESIST  Firm to stiff, brown silty Clay FILL with organics and rock fragments  C 10 P  Firm to stiff, gray, medium plastic Silty CLAY with organics  C 12 P  Firm to stiff, brown, low plastic Silty CLAY   | vATIOMS anced h diam w stem - |
|--|-------------------------------|
| Firm to stiff, brown silty Clay FILL with organics and rock fragments  C 10 18 P  Firm to stiff, gray, medium plastic Silty CLAY with organics  C 12 P  Firm to stiff, brown, low plastic Silty  Fill Boring advance with 6-incle eter hollow auger Some auger  C 10 18 P  Firm to stiff, gray, medium plastic Silty | h diam- —<br>w stem —<br>—    |
| Firm to stiff, gray, medium plastic  Silty CLAY with organics  C 12 P Firm to stiff, brown, low plastic Silty  Some auger  CL Stream dep   | · -                           |
| 5 C 12 P Firm to stiff, brown, low plastic Silty   | osit                          |
| Firm to stiff, brown, low plastic Silty  |                               |
|  |                               |
| ATD Modified 1   |                               |
| C 14 P   | _                             |
|  | -                             |
| -    -   -   -   -   -   -   -   -   | _                             |
| -    -         -   |                               |
|  | -                             |
| Becoming low to medium plastic   |                               |
| C 15 P   |                               |
|  | -                             |
| Stiff to hard, light tan-brown and gray _ CH Residual  | <del>-</del>                  |
| highly plastic CLAY with trace silt  |                               |
| C 13 P Bottom of 20 ft   |                               |
|  | _                             |
|  |                               |
| 25 WOODWARD-CLYDE CONSULTANTS FIGURE NO  |                               |

| PROJECT NAME   | ORTHO CHEVRON                                   | PROJECT NO. S81-5                               |
|----------------|---|---|
| B-219          | PROJECT LOCATION ST. LOUIS, MISSOURI            | DATE 1/27/81<br>RIG CME 750                     |
| SURFACE ELEVAT | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERSE 1 512 ATD<br>Hole caved 24 hrs AD |

| DEPTH |      | AMPLE           | ·····  |  | l     | SPECIAL NOTES AND                                 |
|-------|------|-----------------|--------|--|-------|---|
| 0 -   | TYPE | REC             | RESIST | DESCRIPTION                                    | U.S.C | FIELD OBSERVATIONS                                |
|       |      |                 |        | Ballast and loose Gravel FILL<br>-             | FILL  | Boring advanced with 6-inch diam eter hollow stem |
| -     | С    | 10<br>18        | P      | Stiff, brown, low plastic silty Clay FILL      |       | auger   |
|       |      |                 |        |  |       |   |
| 5     | С    | 8<br>18         | Р      | <del>-</del>                                   |       |   |
| _     | С    | 14              | Р      |  | 4     | -   |
|       |      | 18              |        | Stiff, brown, low to medium plastic Silty CLAY | CL    | Modified loess                                    |
|       |      |                 |        | <br><del> </del>                               | 4     | -   |
| 10    | С    | 14<br>18        | Р      | · ·  | -     | -   |
| -     |      |                 |        | -<br>-   |       |   |
|       |      |                 |        | _  | 4     | _   |
| 15    |      |                 |        | <del>-</del>                                   | 1     | ATD   |
| -     | С    | <u>16</u><br>18 | Р      | <del></del><br>-                               |       |   |
| -     |      |                 |        | <del>-</del>                                   | 4     | -   |
| -     |      |                 |        |  | }     | -   |
| 20    | С    | 12              | Р      | <del>-</del>                                   |       |   |
| _     |      | 12<br>18        | -      | <del>-</del>                                   | -     | -   |
|       |      |                 |        | _  | 1     | -   |
|       |      |                 |        | <ul><li>Becoming more plastic</li></ul>        |       |   |
| 25    |      |                 |        | WOODWARD-CLYDE CONSULTANTS                     | i     | FIGURE NO. A-35                                   |

| PROJECT NAME      | ORTHO CHEVRON  | SHEET OF                    |
|-------------------|--|-----------------------------|
| B-219             | PROJECT LOCATION ST. LOUIS, MISSOURI                                       | DATE 1/27/81<br>RIG CME 750 |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanni 527 ELEVATION DATUM USC & GS |                             |

| DEPTH SAMPLE         |      |                |        | <u>-</u>   |     | SPECIAL NOTES AND |                             |
|----------------------|------|----------------|--------|--|-----|-------------------|-----------------------------|
| _                    | TYPE | REC            | RESIST | DESCRIPTION  |     | U. S. C.          | FIELD OBSERVATIONS          |
| 25 <del>-</del><br>- | C    | 12<br>18       | Р      | SAME: Stiff, brown, medium plastic Silty CLAY                            | -   | CL                | _                           |
| -                    |      |                |        | _  | 4   |                   |                             |
| _                    |      |                |        | Stiff, gray, brown and purple, highly                                    |     | СН                | Residual                    |
| 3 <u>0</u>           |      | l              |        | <ul> <li>plastic CLAY with chert fragments and<br/>trace silt</li> </ul> |     |                   |                             |
|                      | С    | <u>7</u><br>18 | Р      | <del>-</del>   | -   |                   |                             |
| -                    |      |                |        | _  | . 4 |                   | Bottom of Boring<br>31.5 ft |
| _                    |      |                |        | <b></b>  | +   | 1                 | _                           |
| 35_                  |      |                |        |  |     |                   |                             |
| _                    |      |                |        | <u>-</u>   | 4   |                   | · –                         |
| -                    |      |                |        | <b></b>  |     |                   | -                           |
| _                    |      |                |        | <b></b>  |     |                   | _                           |
|                      | ;    |                |        |  | _   |                   | -                           |
| 1                    |      |                |        | _  | -   |                   | , -                         |
| _                    |      |                |        | _  | 4   |                   | <del>-</del>                |
|                      |      |                |        | <del>-</del><br>-  |     |                   |                             |
|                      |      |                |        |  |     |                   |                             |
| -                    |      |                |        |  | -   |                   | -                           |
| 4                    |      |                |        | _  | 4   | į                 | -                           |
|                      |      |                |        | -<br>-   | 1   |                   | -                           |
|                      |      |                |        |  |     |                   |                             |
|                      |      |                |        | WOODWARD-CLYDE CONSULTANTS   |     | į                 | FIGURE NO. A-36             |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5           |
|-------------------|---|-----------------------------|
| 0WC-1             | PROJECT LOCATIONST. LOUIS, MISSOURI             | DATE 2/18/81<br>RIG CME 750 |
|                   | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS None           |
| SURFACE ELEVATION | 541ELEVATION DATUM USC & GS                     | detected ATD                |

| [DEDTU |      | AMDLE        |        |   |          | SPECIAL NOTES AND  |
|--------|------|--------------|--------|---|----------|--|
| DEPTH  | TYPE | AMPLE<br>REC | RESIST | DESCRIPTION   | U. S. C. | FIELD OBSERVATIONS   |
|        |      |              |        | Firm to stiff, brown, low plastic, Silty<br>- CLAY -    | CL       | Boring advanced with 6-inch diam eter hollow stem auger, lower 5-feet- 8-inch diameter |
| 5_     |      |              |        | -<br>-<br>-   |          | -<br>Modified loess  |
|        |      |              |        | -<br>-<br>-   |          |  |
|        |      |              |        | -<br>-  |          |  |
| 10     |      |              |        | <del></del>   |          |  |
|        |      |              |        | - Popular modium plantic                                |          | _  |
| 15     |      |              |        | Becoming medium plastic                                 |          |  |
|        |      |              |        | Hard, tan-brown, highly plastic CLAY with trace of silt | СН       | Residual —   |
| 20     |      |              |        | Becoming multi-colored with shaley sections             |          |  |
|        |      |              |        |   |          | -  |
| 25_    |      |              |        |   |          | Bottom of Boring<br>23 ft  |
|        |      |              |        | WOODWARD-CLYDE CONSULTANTS                              |          | FIGURE NO. A-37  |

| PROJECT NAME        | ORTHO CHEVRON  | PROJECT NO. S81-5              |
|---------------------|--|--------------------------------|
| OWC-2               | PROJECT LOCATION ST. LOUIS, MISSOURI   | DATE 2/17/81 RIG CME 750       |
| SURFACE ELEVATION _ | LOGGED BY Peter Barrett DRILLED BY G. Johanning 541 ELEVATION DATUM USC & GS | WATER ENTERS None detected ATD |

| DEDT   |      | AMO: F           |        |  |           |          | SPECIAL NOTES AND  |
|--------|------|------------------|--------|--|-----------|----------|--|
| DEPTH  | TYPE | AMPLE<br>REC     | RESIST | DESCRIPTION  |           | U.S.C.   | FIELD OBSERVATIONS   |
| 0 -    |      |                  |        | Firm to stiff, brown, low plastic<br>Silty CLAY      | 1         | CL       | Boring advanced<br>with 6-inch diam- —<br>eter hollow stem |
| -      | С    | 15<br>18         | В      | -<br>-   | 1         | :        | auger Lower 5 ft —<br>8-inch diameter<br>Modified loess —  |
| -<br>5 |      |                  |        | · ·  | _         |          |  |
| -      | С    | 1 <u>5</u><br>18 | Р      | _  | 1         |          | _  |
| -      |      |                  |        | <u> </u>   | T         |          | -  |
| 10     |      |                  |        | —<br>With iron staining                              | -         |          |  |
|        | С    | 14<br>18         | Р      |  | -         |          |  |
| _      |      |                  |        | _  | -         |          | _  |
| -      |      |                  |        | Becoming medium plastic                              | _         |          | _  |
| 15     | С    | 15<br>18         | P      |  |           |          |  |
|        |      |                  |        | Hard, tan-brown, highly plastic CLAY with trace silt | •         | СН       | Residual _   |
| -      |      |                  |        | <del>-</del>   | -         |          | _  |
| 20     | С    | 15<br>18         | P      | With blue-gray color also                            | <u></u> : |          |  |
| -      |      | 10               |        | -<br>-   | -         |          | -<br>  |
| -      |      |                  |        | Hard, multi-colored, highly plastic                  |           | СН       | _  |
| 25_    |      |                  |        | CLAY with shaley sections                            |           | w/<br>SH | <del>-</del>   |

| PROJECT NAME      | ORTHO CHEVRON  | PROJECT NO. S81-5              | _ |
|-------------------|--|--------------------------------|---|
| OWC-2             | PROJECT LOCATION ST. LOUIS, MISSOURI   | DATE 2/17/81 RIG CME-750       |   |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning 541 ELEVATION DATUM USC & GS | WATER ENTERS None detected ATD |   |

| DEPTH | S    | AMPLE    |        | DESCRIPTION   | u.s.c.    | SPECIAL NOTES AND  |
|-------|------|----------|--------|---|-----------|--------------------|
| 25    | TYPE | REC      | RESIST |   |           | FIELD OBSERVATIONS |
| _     | С    | 13<br>18 | Р      | SAME: Hard, multi-colored, highly plastic CLAY with shaley sections | CH-<br>SH | -                  |
| -     |      |          |        | ·<br><del>-</del>   | -         | -                  |
| -     |      |          |        | <del>_</del>  | -         | -                  |
| 30    |      |          |        |   |           |                    |
|       | С    | 7 17     | Р      | <del>-</del><br>-   |           |                    |
| 4     |      |          |        | _   | -         |                    |
| -     |      |          |        | _   | ┨         |                    |
| 35    |      |          |        |   |           | -                  |
|       | С    | 6/6      | P      | Becoming predominantly gray, with fine sand                         | ]         | -                  |
| 4     |      |          |        | _   | -         | -                  |
| 4     |      | :        |        | <b>_</b>  | -         | -                  |
| 40    |      |          |        | <u>-</u>  | 1         | -                  |
|       |      |          |        | <del></del>   |           | _                  |
| 4     | I    |          |        | _   | -         |                    |
| 4     |      |          |        | _   | -         |                    |
| 45    |      |          |        | _   |           |                    |
| '-    |      |          |        | <del></del>   |           | _                  |
| ]     |      |          |        | LIMESTONE: Gray, poorly cemented                                    | LS        |                    |
| 4     |      |          |        | _ SHALE: Gray .   | SH        | -                  |
| 50    |      |          |        |   | 1         | -                  |
|       |      |          |        | WOODWARD-CLYDE CONSULTANTS  |           | FIGURE NO. A-39    |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5        |
|-------------------|---|--------------------------|
| OWC-2             | PROJECT LOCATION ST. LOUIS, MISSOURI            | DATE 2/17/81 RIG CME-750 |
|                   | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERSNONE         |
| SURFACE ELEVATION | 541 ELEVATION DATUM USC & GS                    | detected ATD             |

| SURFACI     | E ELE                        | VATION          | i               | 541 ELEVATION DATUM USC & GS  |          | detected ATD   |
|-------------|------------------------------|-----------------|-----------------|---|----------|--|
| DEPTH       | S<br>TYPE                    | AMPLE<br>REC    | RESIST          | DESCRIPTION   | U. S. C. | SPECIAL NOTES AND FIELD OBSERVATIONS   |
| -           |                              |                 |                 | SAME: SHALE: gray   | SH       | -  |
| 55          |                              |                 |                 |   |          | -  |
| 60 <u> </u> | CORE                         | 4/4             | 4/4             | CHERT with some pyrite and some small   | LS       | Auger refusal 61.5   |
| 65          | RUN<br>1<br>CORE<br>RUN<br>2 | <u>56</u><br>56 | <u>56</u><br>56 | 1/8 inch diameter solution holes LIMESTONE: Light gray, unweathered, massive bedded |          | with NX Core Barrel with diamond bit and water  Run 1 - Start: 61.5 Stop: 61.8 - Rec: 100% DWR: 100% |
| 70          | CORE<br>RUN<br>3             |                 | 36<br>36        | -<br>-<br>-   |          | Run 2 Start: 61.8 Stop: 66.5 Rec: 100% DWR: 100% Run 3 Start: 66.5                                   |
| -           |                              |                 |                 | -<br>-<br>-   |          | Stop: 69.5 Rec: 100% DWR: 100%  Bottom of Boring 69.5 ft   |
| 75          | <u>i</u>                     |                 |                 | WOODWARD-CLYDE CONSULTANTS  |          | FIGURE NO. A-40  |

| PROJECT NAME      | ORTHO CHEVRON  | SHEET OF                |  |  |
|-------------------|--|-------------------------|--|--|
| OWC-3             | PROJECT LOCATIONST. LOUIS, MISSOURI  |                         |  |  |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning 529 ELEVATION DATUM USC & GS | WATER ENTERS E1 527 ATD |  |  |
| DEPTH SAMPLE      |  | SPECIAL NOTES AND       |  |  |

| SURFAC | E ELE | VALION   | 525    |         | ELEVATION DATUM USC & GS  |            |          |   |
|--------|-------|----------|--------|---------|---|------------|----------|---|
| DEPTH  | S     | AMPLE    |        |         | DECODINE  |            | u. s. c. | SPECIAL NOTES AND   |
| 0 -    | TYPE  | REC      | RESIST |         | DESCRIPTION   |            | 0. 5. 6. | FIELD OBSERVATIONS  |
| 1      | С     | 13<br>18 | P      | -       | Firm to stiff, brown silty Clay FILL                            | . <b>-</b> | FILL     | with 6-inch diam- —<br>eter hollow stem<br>← ATD —<br>auger, Lower 5 ft |
| 5_     | С     | 14<br>18 | P      |         | Stiff, brown, low to medium plastic<br>Silty CLAY with organics |            | CL       | 8-inch diameter —<br>—<br>Modified loess —                              |
| -      | С     | 15<br>18 | P      | -<br> - |   | -          |          | -   |
|        |       | 18       |        | -<br> - |   |            |          | _   |
| 10     | С     | 16<br>18 | Р      | _       |   |            |          |   |
|        |       |          |        |         |   | -          |          |   |
| 15     |       |          |        | -       | Becoming medium to low plastic                                  | ·<br>      | ·        | _   |
| -      | С     | 14<br>18 | Р      | _       |   | _          |          | _   |
|        |       |          |        | _       |   | -          |          | _   |
| 20 _   | С     | 16       | Р      | _       | Hard, brown, highly plastic CLAY with trace silt                |            | СН       | Residual —  |
|        |       | 18       |        | -       |   | -          |          | -   |
|        |       |          |        | _       | Becoming light gray   | 1          |          | -   |
| 25     |       |          |        |         | WOODWARD-CLYDE CONSULTANTS                                      |            | · -      | FIGURE NO. A-41   |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5        |
|-------------------|---|--------------------------|
| OWC-3             | PROJECT LOCATIONST. LOUIS, MISSOURI             | DATE 2/16/81 RIG CME-750 |
|                   | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS E1 527 AT   |
| SURFACE ELEVATION | I 529 FLEVATION DATUM USC & GS                  | •                        |

| DEPTH SAMPLE |      |                 |          | DESCRIPTION                           |   |    | SPECIAL NOTES AND  |
|--------------|------|-----------------|----------|---------------------------------------|---|----|--------------------|
| 25 _         | TYPE | TYPE REC RESIST |          | DESCRIPTION                           |   |    | FIELD OBSERVATIONS |
|              |      |                 |          | SAME: Hard, gray, highly plastic CLAY |   | СН |                    |
| -            |      |                 |          | <b>-</b>                              | ┪ |    | _                  |
|              |      |                 |          |                                       |   |    |                    |
|              |      |                 |          |                                       |   |    |                    |
| _            |      |                 |          | -                                     | - |    | -                  |
|              |      |                 |          | ·                                     |   |    | _                  |
|              |      |                 |          |                                       |   |    |                    |
| 30           |      |                 | İ        | Stiff, purple, highly plastic CLAY    | - |    | <del></del>        |
|              | ,    |                 |          |                                       |   |    |                    |
|              |      |                 |          | ·                                     |   |    |                    |
| -            |      |                 |          | -                                     | 4 |    |                    |
|              |      |                 |          |                                       |   |    | _                  |
|              |      |                 |          |                                       |   |    |                    |
| -            |      |                 | 1        | <del> </del>                          | 4 |    | -                  |
| 35           |      |                 |          |                                       |   |    |                    |
|              |      |                 | Ì        | · .                                   |   |    | Bottom of Boring   |
| _            |      |                 |          | -                                     | - |    | 35 ft              |
|              |      |                 |          |                                       |   |    | Auger refusal 35'  |
|              |      |                 |          | <del>-</del>                          | 7 |    | _                  |
| -            |      |                 |          | <u> </u>                              | 4 |    | _                  |
|              |      |                 |          |                                       |   |    | <u>.</u>           |
|              |      |                 |          |                                       | 7 |    | -                  |
| 40           |      |                 |          | <del></del>                           |   |    |                    |
|              |      |                 |          |                                       |   |    |                    |
| 7            | 1    |                 |          |                                       |   |    |                    |
| -            |      |                 |          | <b>L</b>                              | 4 |    | -                  |
|              |      |                 | }        |                                       |   |    | <u> </u>           |
|              |      |                 |          | Γ                                     |   |    | _                  |
| -            |      |                 |          | <u>L</u>                              | 4 |    | _                  |
|              |      |                 |          |                                       |   |    | . <u> </u>         |
|              |      |                 | 1        |                                       |   |    |                    |
|              | ·    |                 | 1        | <del> -</del>                         | 4 |    | -                  |
|              |      |                 | <b>.</b> |                                       |   |    |                    |
|              |      |                 |          |                                       | 7 |    | _                  |
| _            |      |                 |          | <del> </del>                          | 4 |    | ļ                  |
|              |      |                 |          |                                       |   |    |                    |
|              |      |                 |          | <u> </u>                              | ٦ |    | _                  |
| -            |      |                 |          | <u> </u>                              |   |    | FIGURE NO A-//2    |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAME        | ORTHO CHEVRON  | PROJECT NO. S81-5        |
|---------------------|--|--------------------------|
| OWC-4               | PROJECT LOCATIONST. LOUIS, MISSOURI  | DATE 2/16/81 RIG CME-750 |
| SURFACE ELEVATION _ | LOGGED BY Peter Barrett DRILLED BY G. Johanning 519 ELEVATION DATUM USC & GS | WATER ENTERSET 509 ATD   |

| SURFAC | CE ELE    | VATION   | וכ     | ELEVATION DATUM USC & GS                                      |          |  |
|--------|-----------|----------|--------|---|----------|--|
| DEPTH  | S<br>TYPE | AMPLE    | RESIST | DESCRIPTION   | U. S. C. | SPECIAL NOTES AND FIELD OBSERVATIONS   |
| -      | С         | 12<br>18 | P      | Firm to stiff, brown, silty Clay FILL                         | FILL     | Boring advanced with 6-inch diam- eter hollow stem auger, Lower 5 ft 8-inch diameter |
| 5      |           |          |        | <u> </u>  |          | -  |
| -      | С         | 14<br>18 | Р      | Stiff, brown, low to medium plastic - Silty CLAY              | CL       | Modified loess<br>-  |
|        |           |          |        | -<br>-  | 4        | _  |
| 10     | С         | 14<br>18 | Р      | Becoming more silty   |          | <b>4</b> ATD   |
| -      |           |          |        | <u>-</u>  | +        | _  |
| 15     | C         | 14<br>18 | Р      | Becoming medium plastic                                       |          | -<br>  |
| -      |           |          |        | -<br>-  | -        | <u>-</u>   |
| 20     | С         | 12<br>18 | P      | Hard, tan-brown, highly plastic CLAY with black iron deposits | CH       | Residual   |
| -      |           |          |        | -<br>-  |          | -  |
| 25     |           |          |        | <del>-</del>  |          | -  |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAME      | ORTHO CHEVRON                | PROJECT NO. S81-5       |
|-------------------|------------------------------|-------------------------|
| OWC-4             | ST. LOUIS, MISSOURI          | DATE 2/16/81            |
| UWC-4             | PROJECT LOCATION             | WATER ENTERS E1 509 ATD |
| SURFACE ELEVATION | 519 FLEVATION DATUM USC & GS |                         |

| SURFACE ELEVATION DATUM OUT OF |      |                            |  |             |   |   |          |                  |                      |   |
|--------------------------------|------|----------------------------|--|-------------|---|---|----------|------------------|----------------------|---|
| DEPTH                          | TYPE | SAMPLE TYPE   REC   RESIST |  | DESCRIPTION |   |   | U. S. C. | SPECIAL FIELD OF | NOTES AND SERVATIONS |   |
| 25 -                           |      |                            |  | SAME:       | Hard, highly plastic CLAY,<br>becoming brown and purple |   | СН       |                  |                      |   |
| _                              |      |                            |  |             | bookining brown and parpro                              |   | ·        | į                |                      |   |
| _                              |      |                            |  |             |   |   |          |                  |                      | _ |
|                                |      |                            |  |             |   |   |          |                  |                      |   |
| 30                             |      |                            |  | <u> </u>    |   |   |          | Bottom           | of Boring            | _ |
|                                |      |                            |  |             |   |   |          | Auger r          |                      |   |
|                                |      |                            |  |             |   |   |          | , ago            | 0, 454 ,             |   |
| _                              |      |                            |  |             |   |   |          |                  |                      |   |
| -                              |      |                            |  |             |   |   |          |                  | •                    |   |
| _                              |      |                            |  |             |   |   |          |                  | •                    | _ |
|                                |      |                            |  |             |   |   | !        |                  |                      |   |
| -                              |      | •                          |  | -           |   | - |          |                  |                      |   |
| _                              |      |                            |  | <b>-</b>    |   |   | <br>     |                  | •                    | _ |
| -                              |      | ·                          |  | <u> </u>    |   | - |          |                  |                      | - |
| <b>,</b>                       |      |                            |  | <u> </u>    |   |   |          |                  |                      |   |
|                                |      |                            |  | <del></del> |   |   |          |                  |                      |   |
| -                              | •    |                            |  | -           |   |   |          |                  |                      |   |
| _                              |      |                            |  | -           |   | - |          |                  |                      | - |
| -                              |      |                            |  | -           |   |   |          |                  |                      | _ |
| _                              |      |                            |  | _           |   | - |          |                  |                      | - |
|                                |      |                            |  | <del></del> |   | - |          |                  |                      |   |
| _                              |      |                            |  | _           |   | - |          |                  |                      | - |
| -                              |      |                            |  | <b>–</b>    |   | _ |          |                  |                      | - |
| 4                              |      |                            |  | _           |   | - |          |                  |                      | 4 |
| 4                              |      |                            |  | _           | · · · · · · · · · · · · · · · · · · ·                   | - |          |                  |                      | - |
|                                |      |                            |  |             | WOODWARD OF VOE COMOUNTAINTO                            |   |          |                  | Λ = 1.1.             |   |
|                                |      |                            |  |             | WOODWARD-CLYDE CONSULTANTS                              | _ |          | FIGURE           | NO. A-44             | ŀ |

|              |       |          |               |          | 20111110   |   | SHI                        | EET1OF2                                |  |  |
|--------------|-------|----------|---------------|----------|--|---|----------------------------|--|--|--|
| PROJECT NAME |       |          |               |          | ORTHO CHEVRON  |   | PROJECT NO. \$81-5         |  |  |  |
|              |       |          |               |          | ST. LOUIS, MISSOURI  |   | DATE 2/5/81<br>RIG CME-750 |  |  |  |
| L            |       |          | PR            | OJE(     | CT LOCATION ST. LOUIS, FITSSOORT   |   |                            | TER ENTERS E1 500 ATD                  |  |  |
| SURFAC       | E ELE | EVATION  | F 1           | 15       | ELEVATION DATUM USC & GS   |   |                            | · · · · · · · · · · · · · · · · · · ·  |  |  |
| DEPTH        |       | AMPLE    |               | 1        | DESCRIPTION  |   | U. S. C.                   | SPECIAL NOTES AND                      |  |  |
| 0 -          | TYPE  | REC      | RESIST        | ┢        |  |   |                            | FIELD OBSERVATIONS                     |  |  |
|              |       |          |               | L        | Stiff, brown, silty Clay FILL  | _ | FILL                       | Boring advanced with 6-inch diam-      |  |  |
|              |       |          |               |          |  |   |                            | eter, Lower 5 ft                       |  |  |
|              | С     | 10<br>18 | Р             | T        |  |   |                            | 8-inch diameter -                      |  |  |
| -            |       | 18       | ļ             | <u> </u> | CALLES TO A CALLED CONTRACT OF THE CALLED CON |   |                            | _                                      |  |  |
|              |       |          |               | L        | Stiff, gray, low plastic Silty CLAY  |   | CL                         | Stream deposit                         |  |  |
| 5            |       |          |               | ŀ        |  |   |                            |  |  |  |
| 1            | С     | 15<br>18 | Р             | 厂        |  |   |                            |  |  |  |
| -            |       | 18       |               | F        |  | - |                            |  |  |  |
| _            |       |          |               | 1        | Becoming hard  | _ |                            | _                                      |  |  |
|              | С     | 15<br>18 | P             |          | , and a second s |   |                            |  |  |  |
| 1            |       |          |               | <u> </u> |  |   |                            | <del>-</del>                           |  |  |
| -            |       |          |               | F        | Stiff, brown and gray, medium plastic,   |   |                            | <br>Modified Loess                     |  |  |
| 10_          |       |          | <u> </u>      | L.       | Silty CLAY   |   |                            | —————————————————————————————————————— |  |  |
|              | С     | 14<br>18 | P             | l        |  |   |                            |  |  |  |
|              |       | Li       | <u> </u>      | ┢        |  | _ |                            | _                                      |  |  |
| -            | С     | 14       | P             | ┢        |  |   |                            | <u> </u>                               |  |  |
|              |       | 18       | '             |          |  |   |                            |  |  |  |
| }            |       | <b>_</b> | ┼             | -        |  |   |                            |  |  |  |
|              |       |          |               | <b> </b> |  | · |                            | 470                                    |  |  |
| 15           |       | 41.      | <del>  </del> | ├        |  |   |                            | <b>←</b> ATD                           |  |  |
| ل ا          | С     | 14       | P             | L        |  | _ |                            | _                                      |  |  |
| 1 1          |       |          | <del> </del>  | ┨        |  |   |                            |  |  |  |
| -            | :     |          | }             | -        | Becoming light brown and gray, stiff,  | - |                            | _                                      |  |  |
| 4            |       |          | ļ             | $\vdash$ | more silty   | _ |                            | -                                      |  |  |
|              | С     | 15<br>18 | P             |          |  |   |                            | · _                                    |  |  |
| 20           |       |          | <del> </del>  | Γ        |  |   |                            | ·                                      |  |  |
| 20           |       |          | ł             | H        |  |   |                            |  |  |  |
|              |       |          | ł             | L        |  | - |                            | -                                      |  |  |
|              |       |          | Ì             |          |  |   |                            | •                                      |  |  |
|              | •     |          |               |          | Hard, yellow-tan, highly plastic CLAY  |   | СН                         | ·                                      |  |  |
| +            | С     | 15       | P             | $\vdash$ |  | _ |                            |  |  |  |
|              | C     | 18       | '             | L        |  | 4 |                            | _                                      |  |  |
| اء ا         |       | <b></b>  | ļ             | ı        | with nurnle shale fragments  | i |                            | Residual                               |  |  |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAME      | ORTHO CHEVRON  | PROJECT NO. S81-5         |
|-------------------|--|---------------------------|
| OWC-5             | PROJECT LOCATION ST. LOUIS, MISSOURI                         | DATE2/5/81<br>RIG CME-750 |
| SUBFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning 515 USC & GS | WATER ENTERS E1 500 ATE   |

| DEPTH    | DEPTH SAMPLE  |                  |        |   | <del></del> | SPECIAL NOTES AND                    |
|----------|---------------|------------------|--------|---|-------------|--------------------------------------|
|          | TYPE          | REC              | RESIST | DESCRIPTION   | U. S. C.    | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 25 -     | С             | 1 <u>3</u><br>18 | Р      | SAME: Hard, yellow-brown, highly plastic<br>CLAY with large purple shale<br>fragments | СН          | _                                    |
| -        |               |                  |        |   |             | Bottom of Boring<br>26.5 ft          |
|          |               |                  |        | -<br>-  |             |                                      |
| 30       |               |                  |        |   |             | ·                                    |
| _        |               |                  |        | <u> </u>  |             |                                      |
|          |               |                  |        | -<br>-  |             | -<br>-                               |
| -        |               |                  |        |   |             | _                                    |
|          |               |                  |        |   |             |                                      |
| -        |               |                  |        | -   |             | ·                                    |
| -        |               |                  |        | -   | 1           | _                                    |
|          |               |                  |        | <del>-</del>  |             |                                      |
|          | ·             |                  |        |   |             | ·                                    |
|          |               |                  |        | -<br>-  |             | _                                    |
|          |               |                  |        | -<br>-  |             |                                      |
|          |               |                  | į      |   |             |                                      |
|          |               |                  |        | -<br>-  |             |                                      |
|          |               |                  |        | . <u>-</u>  |             | -                                    |
| <u> </u> |               |                  |        | -   |             | <u>-</u>                             |
|          | - <del></del> |                  |        | WOODWARD-CLYDE CONSULTANTS  |             | FIGURE NO. A-46                      |

| PROJECT NAME      | ORTHO CHEVRON   | SHEET OF                                   |
|-------------------|---|--|
| owc-6             | PROJECT LOCATION ST. LOUIS, MISSOURI  | DATE 2/2/81 RIG CME-750                    |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning  523 ELEVATION DATUM USC & GS | WATER ENTERS E1 514 ATE<br>E1 516 24 hr AD |

| SURFAC | E ELE | VATION         | 52      | ELEVATION DATUM USC & GS  |        | 1 310 24 III AU   |
|--------|-------|----------------|---------|---|--------|---|
| DEPTH  | S     | AMPLE          | RESIST  | DESCRIPTION   | u.s.c. | SPECIAL NOTES AND FIELD OBSERVATIONS                                |
| 0 -    | TIPE  | REC            | KESIS I | Firm to stiff, brown, silty Clay FILL with                                    | FILL   | Boring advanced with  |
|        | С     | 11<br>18       | Р       | . gravel  |        | 6-inch diameter — hollow stem auger, Lower 5-feet — 8-inch diameter |
|        | С     | <u>8</u><br>18 | P       | -<br>Without gravel   | 1      | -   |
| 5      |       | 10             |         |   |        |   |
| -      | С     | 14<br>18       | Р       | Firm to stiff, brown, medium plastic, - Silty CLAY with filled root holes and | CL     | -   |
| _      |       |                |         | voids<br>-  | _      | 24 hrs AD   |
| 4      |       |                |         | -   | ┪      | -   |
| 10     |       |                |         | -   |        | ATD _   |
|        | С     | 16<br>18       | Р       | - <del></del>   |        |   |
| _      |       |                |         | <u>-</u>  | -      |   |
| _      |       |                |         | <u>.</u>  | -      | _   |
| 15     |       |                |         | -<br>   |        |   |
|        | С     | 14<br>18       | P       | <del>-</del>  |        | _   |
| -      |       |                |         | -   |        | _   |
| _      |       |                |         | <u>.</u>  |        |   |
| 20     |       | 10             |         | Stiff, brown, highly plastic CLAY with  | сн     | Residual  |
| -      | С     | 12<br>18       | P       | silt  |        | nes roug r  |
| -      |       |                |         | •   |        | -   |
|        |       |                |         | •<br>•  |        |   |
| 25_    |       |                |         | Becoming hard   |        |   |
|        |       |                |         | WOODWARD-CLYDE CONSULTANTS  |        | FIGURE NO. A-47   |

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5                          |
|-------------------|---|--|
| owc-6             | PROJECT LOCATION ST. LOUIS, MISSOURI            | DATE 2/2/81<br>RIG CME-750                 |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS El 514 ATT<br>El 516 24 hr AD |

| DEPTH    |      | AMPLE    |        |   | T        | SPECIAL NOTES AND           |
|----------|------|----------|--------|---|----------|-----------------------------|
| 25 -     | TYPE | REC      | RESIST | DESCRIPTION   | U. S. C. | FIELD OBSERVATIONS          |
| 25       | С    | 12<br>18 | Р      | SAME: Hard, varicolored, highly plastic CLAY with shale and fine sand | СН       |                             |
| _        |      |          |        |   |          | Bottom of Boring<br>26.5 ft |
| -        |      |          |        | <u>-</u>  |          | -                           |
| 30       |      |          |        | -<br>   |          |                             |
| _        |      |          |        | _   |          | •                           |
| -        |      |          |        | <b>-</b><br>  |          | -                           |
| _        |      |          |        | -<br>-  |          |                             |
|          |      |          |        |   |          |                             |
| 1        |      |          |        | <u>-</u>  | -        | -                           |
| <b>.</b> |      |          |        | <u>-</u>  |          | -                           |
| 1        |      |          |        | -<br>-  |          | -                           |
| _        |      |          |        |   |          | ·                           |
| _        |      |          |        | -   |          | -                           |
|          |      |          |        | -<br>-  |          |                             |
| -        |      |          |        | <u>-</u>  |          | -                           |
| -        |      |          |        | ·   | 1        | _                           |
| _        |      |          |        | <b>-</b>  |          | -                           |
| -        |      |          |        | -<br>-  |          | _                           |
| 4        |      |          |        | ·<br>-  |          | _                           |
| _=       |      |          |        | WOODWARD-CLYDE CONSULTANTS  | L        | FIGURE NO. A-48             |

| PROJEC     | Τ ΝΔΑ | AE.             |           |                               | ORTHO CHEVRON                                   |          | PR       | OJECT NO. S81-5                      |
|------------|-------|-----------------|-----------|-------------------------------|---|----------|----------|--------------------------------------|
|            |       | 1               |           | DA                            | TE2/18/81                                       |          |          |                                      |
|            |       | PRO             | OJECT     | T LOCATIONST. LOUIS, MISSOURI | _ RI  | GCME-750 |          |                                      |
|            |       |                 | LOC<br>52 | GED                           | BY W. Prosser DRILLED BY G. Johannin            | ng       | _ W      | ATER ENTERSET 516 ATD                |
| SURFAC     | E EL  | EVATION _       |           |                               | ELEVATION DATUM USC & GS                        |          |          | <del>,</del>                         |
| DEPTH<br>0 | TYPE  | SAMPLE<br>REC R | ESIST     |                               | DESCRIPTION                                     |          | U. S. C. | SPECIAL NOTES AND FIELD OBSERVATIONS |
| ľ          |       |                 |           | _                             | 3 inches asphalt                                |          | F        | Boring advanced                      |
| 1 1        |       | 1               | l         | -                             | Loose, black, cinder and Gravel FILL            | -        | i        | with 6-inch diam<br>eter hollow stem |
| 1 4        |       |                 |           |                               |   |          | Ļ        | auger, Lower 5 ft -                  |
|            |       |                 |           | _                             | Stiff, brown, low plastic silty Clay FILL       | _        |          | 8-inch diameter                      |
|            |       | į l             |           | _                             |   |          |          | _                                    |
| _          |       | 1 1             |           | _                             |   |          |          | _                                    |
| 5 —        |       |                 |           |                               |   | _        |          |                                      |
|            |       |                 |           |                               | Firm to stiff, gray, low plastic,<br>Silty CLAY |          | CL       | Strong odor ATD                      |
| 1          |       | ]               | - 5       | -                             | STICY SERV                                      | _        | 1        | Stream deposit                       |
| -          |       | 1 1             | ł         | -                             |   | _        | ł        | Stream deposit                       |
|            |       |                 | 1         | _                             | Stiff, brown, low plastic Silty CLAY            | _        | CL       | Modified loess _                     |
| 10         |       | 1               | - 1       | _                             |   |          |          |                                      |
|            |       |                 |           |                               |   |          |          |                                      |
|            |       |                 | ŀ         | -                             |   | _        |          | _                                    |
|            |       |                 | }         | _                             |   | _        |          | _                                    |
|            |       | 1 ]             | 1         |                               |   | _        |          | _                                    |
|            |       | 1               | i         |                               |   |          |          |                                      |
| 1          |       | 1 1             | ľ         | -                             |   |          | 1        | -                                    |
| 15         |       |                 | ŀ         |                               | Becoming hard and medium to highly              |          | CL-      | Residual                             |
| 1 4        |       | ]               |           | -                             | plastic   |          | СН       | _                                    |
| ]          |       |                 |           |                               |   |          |          |                                      |
| 1          |       |                 |           | _                             |   | _        |          | Bottom of Boring<br>17 ft            |
|            |       |                 | Ì         | _                             |   | _        |          |                                      |
|            |       |                 | -         | -                             |   | _        |          | <u>-</u>                             |
| 20         |       |                 | -         | _                             |   |          |          | _                                    |
|            |       |                 |           | _                             |   |          |          |                                      |
| 7          |       |                 | ſ         | -                             |   |          |          | -                                    |
| -          |       |                 | }         | -                             |   | -        |          | _                                    |
| 4          |       |                 |           | -                             |   | -        |          | -                                    |
|            |       |                 |           | _                             |   | _        |          | -                                    |
| 25         |       |                 | 1         |                               |   |          |          |                                      |

WOODWARD-CLYDE CONSULTANTS

| PROJEC | T NAM    | c            |        |     | ORTHO CHEVRON  |             |                  | EET 1 0F 2  |
|--------|----------|--------------|--------|-----|--|-------------|------------------|---|
| PROJEC | I NAM    |              |        |     |  | <del></del> |                  | TE 2/19/81  |
|        | OWC-8    |              |        | OJE | CT LOCATIONST. LOUIS, MISSOURI                                       | RI          | G <u>CME-750</u> |   |
| SURFAC | E ELE    | VATION       | E 2    |     | D BY Peter Barrett DRILLED BY G. Johanning  ELEVATION DATUM USC ε GS |             | - W/             | ATER ENTERS El 516 ATD  |
| DEPTH  | TYPE     | AMPLE<br>REC | RESIST | -   | DESCRIPTION  | <del></del> | U. S. C.         | SPECIAL NOTES AND FIELD OBSERVATIONS  |
| 0 -    |          |              |        | -   | Loose, black, cinder and Gravel FILL                                 | -           | F - L L          | Boring advanced<br>with 6-inch diam- —<br>eter hollow stem<br>auger, Lower 5 ft — |
|        | С        | 13<br>18     | P      | -   | Stiff, brown, silty Clay FILL  |             |                  | 8-inch diameter Strong odor   |
| -      |          |              |        | }   |  | _           |                  |   |
| 5      | С        | 16<br>18     | P      | F   | Firm to stiff, gray, Silty CLAY                                      |             | CL               |   |
|        | С        | 16<br>18     | P      | -   |  | -           |                  | ATD _   |
| -      |          | 18           |        | -   |  | _           |                  | Stream deposit  |
| -      |          |              |        | -   | Firm to stiff, brown Silty CLAY                                      |             |                  | Modified loess  |
| 10     | С        | 16<br>18     | Р      |     | Becoming stiff   | _           |                  |   |
|        |          |              |        | -   |  | _           |                  | _   |
| 4      |          |              |        |     |  | _           |                  |   |
| 15     | С        | 16           | Р      | _   | Becoming tan to brown, medium plastic                                |             |                  |   |
| -      | <u> </u> | 18           |        | -   |  | _           |                  | _   |
|        | ı        |              |        |     |  | _           |                  | _   |
| -      |          |              |        | _   | Becoming hard  | _           |                  | _   |
| 20     | С        | 16<br>18     | P      |     | Becoming medium to highly plastic                                    |             | CL-              |   |
| }      |          |              |        | F   |  | _           |                  | -   |
| -      |          | '            |        | _   | Chief has be brown 11 this at 1 10 10 10                             |             | CII              | -   |
| 25     |          |              |        | -   | Stiff, tan to brown, highly plastic CLAY with trace silt             |             | СН               | Residual -  |

WOODWARD-CLYDE CONSULTANTS

|          |        |        |             | DONING LOG                                   |          | 2 2                                  |
|----------|--------|--------|-------------|--|----------|--------------------------------------|
| PROJEC   | CT NAM | F      |             | ORTHO CHEVRON                                |          | ROJECT NO. <u>S81-5</u>              |
|          |        |        | <del></del> |  | ··       | ATE 2/19/81                          |
| (        | 0WC-8  |        | PR          | OJECT LOCATIONST. LOUIS, MISSOURI            | RI       | IGCME-750                            |
| L        |        |        | _ 0         | GED BY Peter Barrett DRILLED BY G. Johanning | w        | ATER ENTERS El 516 ATD               |
| SURFA    | CE ELE | VATION | 52          | ELEVATION DATUM USC & GS                     |          |                                      |
| DEPTH    | TYPE   | AMPLE  | RESIST      | DESCRIPTION                                  | U. S. C. | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 25 _     | C      | 16     | P           | SAME: Stiff, tan-brown, highly plastic       | СН       | FIEED OBSERVATIONS                   |
| _        | 1      | 18     |             | - CLAY with trace silt                       | 4        | 4                                    |
| İ        |        |        |             |  |          |                                      |
| _        | ]      |        |             | -  | 7        | Dotton of Ponica                     |
| -        | i      |        |             | -  | ┥        | Bottom of Boring<br>27.5 ft          |
| _        |        |        |             | _  | _        |                                      |
| 30       |        |        |             |  |          |                                      |
| ~ —      | 1      |        |             | <del></del>                                  | 7        |                                      |
| -        | 1      |        |             | -  | 4        | -                                    |
| _        |        |        |             | _  |          |                                      |
|          | ı      |        |             |  |          | +                                    |
| -        |        |        |             | -  | 7        |                                      |
| -        |        |        |             | -  | -        | - 4                                  |
| <u> </u> | 1      |        |             |  |          |                                      |
|          |        |        |             |  |          |                                      |
| -        |        |        |             | -  | -        |                                      |
| _        | }      |        |             | _  | _        | 4                                    |
|          |        |        |             |  |          |                                      |
|          |        |        |             | _  | 7        | ]                                    |
| -        | ·      |        |             | -  | ┥        | -                                    |
| _        |        |        |             |  | 4        |                                      |
|          |        |        |             |  |          |                                      |
|          |        |        |             | _  |          |                                      |
| -        |        |        |             | <del>-</del>                                 | -        | -                                    |
|          | 1      |        |             | <del>-</del>                                 |          |                                      |
|          |        |        |             |  |          |                                      |
|          |        |        |             | _  | 7        | 1 7                                  |
| -        |        |        |             | <del>-</del>                                 | -        | -                                    |
|          |        |        |             | _  |          | ]                                    |
|          |        |        |             |  |          | ]                                    |
| -        |        |        |             | _  | -        |                                      |
| 4        |        |        | j           |  | 4        | 4                                    |
|          |        |        |             |  | 1        |                                      |

WOODWARD-CLYDE CONSULTANTS

|                   | BORING LOG                                      | SHEET 1 OF 2            |
|-------------------|---|-------------------------|
| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5       |
|                   | T LOUIS MISSOURI                                | DATE 1/28/81            |
| OWC-9             | PROJECT LOCATION                                | RIG CME-750             |
|                   | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS E1 529 ATD |
| SURFACE ELEVATION | 532 ELEVATION DATUM USC & GS                    | El 531 24 hrs AD        |

| SURFA | CE ELI  | EVATION  | 1      | ELEVATION DATUM USC & GS                   |               | EI 531 24 hrs AD  |
|-------|---------|----------|--------|--|---------------|---|
| DEPTH |         | SAMPLE   |        | DESCRIPTION                                | U. S. C.      | SPECIAL NOTES AND   |
| 0 -   | TYPE    | REC      | RESIST | DESCRIPTION                                | U. S. C.      | FIELD OBSERVATIONS  |
|       |         |          |        | Stiff, gray silty Clay FILL with organics  | FILL          | _₩ 24 hrs AD _  |
| -     | C       | 9<br>18  | P      | -  |               | Boring advanced with 6-inch diameter                              |
| -     | С       | 10       | P      | Stiff, gray, low plastic Silty CLAY        | CL            | hollow stem auger,<br>Lower 5 ft, 8-inch<br>Water detected<br>ATD |
| -     |         | 18       |        | with organics                              | -             | Stream deposit -  |
| 5_    | С       | 11 18    | P      | Stiff, brown, low to medium plastic        | 1             | Modified loess  |
| -     |         | 10       |        | _ Silty CLAY .                             | 1             |   |
|       |         |          |        | ·<br>-                                     |               |   |
| _     |         |          |        |  |               | 4   |
| 10    | С       | 16       | P      |  | $\frac{1}{2}$ | _   |
| -     |         | 16<br>18 |        | -  | -             | -   |
| -     |         |          |        | _  | -             | -   |
| -     |         |          |        | Very stiff, red-brown, highly plastic CLAY | CH            | Residual  |
| 15_   | 1       |          |        | <del>-</del>                               | 1             | -   |
| -     | С       | 12<br>18 | Р      | <del></del>                                |               |   |
| _     | ļ       | -        |        | _  | 1             | 4   |
| _     | ]       |          |        | -  | -             | -   |
| -     | -       |          |        | <del>-</del>                               | -             | -   |
| 20 —  | С       | 11       | P      | Becoming brown, with black ferrous         | 1             | -   |
| -     |         | 18       |        | _ deposits _                               | 1             | -   |
| -     |         |          |        | -  | 1             |   |
|       |         |          |        | •<br>•                                     |               | ]   |
| 25    | <u></u> |          |        |  | <u></u>       | <u> </u>  |
|       | 3       |          |        | WOODWARD CLYDE CONSULTANTS                 |               | CICUDE NO A-52  |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAME      | ORTHO CHEVRON                                   | PROJECT NO. S81-5       |
|-------------------|---|-------------------------|
|                   | ST. LOUIS, MISSOURT                             | DATE 1/28/81            |
| 0WC-9             | PROJECT LOCATION                                | RIG CME-750             |
| <u></u>           | LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERS E1 529 ATD |
| SURFACE ELEVATION | ELEVATION DATUM USC & GS                        | El 531 24 hrs AD        |

| DEDTI            | _    | AMDLE    |              | T   | <u> </u>  | COECIAL MOTES AND                    |
|------------------|------|----------|--------------|---|-----------|--------------------------------------|
| DEPTH            | TYPE | REC      | RESIST       | DESCRIPTION   | U. S. C.  | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 25 <b>–</b><br>– | С    | 11<br>18 | Р            | SAME: Very stiff, brown, highly plastic<br>CLAY with black ferrous deposits | СН        | _                                    |
| -                |      |          |              | <del> </del><br> -  |           | _                                    |
| _                |      |          |              |   | -         | -                                    |
| _<br>30          |      |          |              | Hard, gray-brown, CLAY with fine sand<br>and shale fragments                | CH-<br>SH |                                      |
| 1                | С    | 8 12     | Р            | -<br>-  |           | _                                    |
|                  |      |          |              | -   |           | -                                    |
|                  |      |          | <u> </u><br> | _   |           | -                                    |
| -<br>35—         |      |          | P            | Becoming orange-brown, without fine sand;                                   |           | _                                    |
| -                | С    | 6<br>18  |              | very shaley   |           | _                                    |
|                  |      |          |              | _   |           | _                                    |
| _                |      |          |              | <del>-</del><br>-   |           | _                                    |
| 40               |      |          |              |   |           |                                      |
|                  |      |          |              | -   |           | _                                    |
| -                |      |          |              | <del></del>   |           | _                                    |
|                  |      |          |              |   |           | -<br>Auger refusal                   |
| 45               |      |          |              | L I MESTONE   | LS        | Bottom of Boring<br>44.0 ft —        |
| $\dashv$         |      |          |              |   |           | -                                    |
| -                |      |          |              | <del>-</del>  |           | -                                    |
|                  |      |          |              | <del>-</del><br>-   |           | _                                    |
| 50               |      |          |              | WOODWARD-CLYDE CONSULTANTS  |           | FIGURE NO. A-53                      |

|          |   |              |  |          |   |                  | SHEET1 OF2                |
|----------|---|--------------|--|----------|---|------------------|---------------------------|
| PROJEC   | T NAM                                       | 1E           |  |          | ORTHO CHEVRON                                     | !                | PROJECT NO. <u>\$81-5</u> |
|          | OWC-10 PROJECT LOCATION ST. LOUIS, MISSOURI |              |  |          |   |                  | DATE                      |
| <u> </u> |   |              | _] ["  | GGE      | D BY Peter Barrett DRILLED BY G. Johanning        |                  | WATER ENTERSET 523 ATD    |
| SURFAC   | E ELI                                       | EVATION      |  |          | ELEVATION DATUM USC & GS                          |                  | E1 523 24 Hr AI           |
| DEPTH    |   | SAMPLE       |  |          |   | <del>- , -</del> | SPECIAL NOTES AND         |
| 0_       | TYPE  | REC          | RESIST   | L        | DESCRIPTION                                       | U.S.             | C. FIELD OBSERVATIONS     |
|          |   |              |  | ├        | Loose, gravel and asphalt FILL                    | F                | 1                         |
| -        |   |              |  | <u> </u> | Stiff, brown, highly plastic clay FILL            | <del>-</del> ╡ [ | 7                         |
| 1 4      | С   | 10<br>18     | Р  | L        | Stiff, brown, highly plastic Clay FILL            | -   ï            | 1 - 1                     |
|          |   | '6           |  |          |   |                  | with odor                 |
|          | С   |              |  |          | Gravel and asphalt                                |                  | 1                         |
| -        | <del></del>                                 | - 5          | P  | $\vdash$ | Stiff, brown-gray, plastic Clay FILL              | 4                | <b>4</b> ——ATD            |
| 5        |   | 18           |  |          | with brick and organics                           |                  | ▼ 24 hr AD                |
|          |   | <del> </del> | <del>                                     </del> |          |   |                  |                           |
|          | С   | 10           | P  | <b> </b> | Stiff, gray, low plastic Silty CLAY               | CL               | Stream deposit            |
|          |   | 18           |  | ļ.       | ·   | 4                | -                         |
|          |   | <del> </del> |  | Ì        |   |                  |                           |
|          | С   | 11           | Р  |          |   | 7                | Organically stained       |
| -        |   | 18           |  | L        |   | -                | organicarry starned       |
| 10       |   |              |  |          | Chiff have leaded and the chiff                   |                  |                           |
|          | C   | 11           | Р  |          | Stiff, brown, low to medium plastic<br>Silty CLAY |                  | ļ                         |
| -        |   | 18           |  | -        | ,   | $\dashv$         | Modified loess -          |
| _        |   |              |  | L        |   | 4                | (without odor)            |
|          |   |              |  |          |   | ł                |                           |
|          |   |              | 1  |          |   | 7                |                           |
|          |   |              |  | F        |   | 4                | -                         |
| 15       |   |              |  |          |   |                  |                           |
|          | С   | 16           | Р  |          |   |                  |                           |
|          |   | 18           |  | ┝        |   | 4                | -                         |
| ▎▗▏      |   |              |  | L        |   | 4                | -                         |
| ]        |   |              |  |          |   |                  |                           |
|          |   |              |  |          |   | 7                | 1                         |
| ] -      |   |              |  | H        | Becoming predominantly gray                       | 4                | -                         |
| 20       |   |              |  |          |   |                  |                           |
|          | С   | 14<br>18     | Р  |          |   | ]                |                           |
|          |   | וא           |  | H        |   | 4                | -                         |
|          |   |              |  |          |   |                  |                           |
|          |   |              |  |          |   |                  |                           |
|          |   |              |  | -        |   | 7                |                           |
|          |   |              |  | _        |   | 4                | 4                         |
| 25       |   |              |  |          |   |                  |                           |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAME        | ORTHO CHEVRON  | PROJECT NO. S81-5                   |
|---------------------|--|-------------------------------------|
|                     | 1  | DATE 1/28/81                        |
| 0WC-10              | PROJECT LOCATION ST. LOUIS, MISSOURI LOGGED BY Peter Barrett DRILLED BY G. Johanning | RIG CME-750 WATER ENTERS El 523 ATD |
| SURFACE ELEVATION _ | 528 ELEVATION DATUM USC & GS   | E1 523 24 hrs AD                    |

| DEPTH           | TYPE | AMPLE    | RESIST | DESCRIPTION   | U. S. C.  | SPECIAL NOTES AND FIELD OBSERVATIONS |
|-----------------|------|----------|--------|---|-----------|--------------------------------------|
| 25 -            | C    | 16<br>18 | P      | SAME: Stiff, gray with brown, medium plastic Silty CLAY -   | CL        | TILLU OBSERVATIONS                   |
| 30_             |      | 7.78     |        | Stiff, brown and purple, medium plastic Silty CLAY with shale fragments and fine sand                                   | CL-<br>CH | Residual                             |
| -               | C    | 6/8      | Р      | <del>-</del>  |           | _                                    |
| -               |      |          |        |   |           | _                                    |
| -<br>3 <u>5</u> | С    | 14       | 6      | <ul> <li>Firm, multi-colored, highly plastic</li> <li>CLAY with limestone and shale fragments—and trace silt</li> </ul> | СН        | -<br>-                               |
| _               |      | 14       | 7      | LIMESTONE _   | LS        | Bottom of Boring _                   |
| -               |      |          |        | _ = = = =   |           | 36.8 ft —                            |
|                 |      |          |        | <del>-</del>  |           | _                                    |
| 40              |      |          |        | <u> </u>  |           | _                                    |
| -               |      | ı        |        | <br>  |           |                                      |
| ,               |      |          |        |   |           | -                                    |
| -               |      |          |        |   |           | -                                    |
|                 |      |          |        |   | ]         |                                      |
|                 |      |          |        |   |           |                                      |
| -               |      |          |        | <del></del>   |           | _                                    |
| _               |      |          |        |   |           | _                                    |

WOODWARD-CLYDE CONSULTANTS

| PROJEC        | T NAM  | Ε                | ····     | ORTHO CHEVRON                               | Pf         | ROJECT NO. \$81-5                    |
|---------------|--------|------------------|----------|---|------------|--------------------------------------|
|               | DWC-11 |                  | PR       | ECT LOCATIONST. LOUIS, MISSOURI             | Þ          | 1/27/81<br>CME-750                   |
| <b></b>       |        |                  | [0       | ED BY Peter Barrett DRILLED BY G. Johanning | w          | ATER ENTERS 503.5 ATD                |
| SURFAC        | CE ELE | EVATION          | 52       | ELEVATION DATUM USC & GS                    |            | El 514 24 hrs AD                     |
| DEPTH         | TYPE   | REC              | PESIST   | DESCRIPTION                                 | U.S.C      | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 0 -           | 11,1   | 11.20            | IVESIS:  | Asphalt Stiff, brown, silty Clay FIII       | F          | with odor                            |
| _             |        | <b> </b>         |          | Still, blown, Stity Clay Fill               | 4 1        | Boring advanced with                 |
|               | С      | 6<br>18          | P        |   | Ĺ          | 6-inch diameter                      |
| -             |        |                  |          |   | - L        | hollow stem auger,                   |
|               |        |                  |          | Becoming firm to stiff, with organic zon    | e <u>s</u> | Lower 5 ft, 8-inch                   |
|               | С      | 5<br>18          | Р        |   |            |                                      |
| -             |        | 10               |          |   | 4          | -                                    |
| 5             |        |                  |          | _   |            |                                      |
|               | С      | 4/6              | Р        |   | _          |                                      |
| -             | -      | 14               | P        | Rubble,_asphalt                             |            | 1 -                                  |
|               |        | 18               |          | Stiff, gray, Silty CLAY                     | CL         | Stream deposit                       |
| ] -           |        |                  |          |   |            |                                      |
| -             | С      | 12               | Р        | Stiff, brown, Silty CLAY with organics      | -          | Modified Loess                       |
|               |        | 13<br>18         |          | serving brown, strey dear with organics     | ]          | Less odor (only                      |
|               |        | <u> </u>         |          |   | ٦          | just detectable)                     |
| 10            | C      | 12               | P        | <del>-</del>                                |            | _₩ 24 hrs AD                         |
|               |        | 1 <u>3</u><br>18 | ۲        |   |            |                                      |
|               |        |                  |          |   | 7          |                                      |
| -             |        |                  |          |   | 4          | -                                    |
|               |        |                  |          |   | 1          |                                      |
| ~             |        |                  |          |   |            | _                                    |
| _             |        |                  |          |   | 4          | -                                    |
| 15            |        |                  |          |   |            |                                      |
| ''-           | С      | 14               | Р        | _   |            |                                      |
| _             |        | 14<br>18         |          |   | 4          | 1 -                                  |
| ]             |        |                  |          |   |            |                                      |
| -             |        |                  | İ        |   | 7          | 1                                    |
| ] _           |        |                  | ]        |   | 4          | ] 4                                  |
|               |        |                  |          |   |            |                                      |
| -             |        |                  | ł        |   | 7          |                                      |
| 20            | _      | 1                |          | _   | _          |                                      |
|               | С      | 13<br>18         | P        |   |            | <b>←</b> ——ATD                       |
| -             |        | . `              | <b>}</b> |   | $\dashv$   |                                      |
|               |        |                  |          |   |            |                                      |
|               |        |                  |          |   |            |                                      |
| ] -{          |        | {                | }        |   | 4          |                                      |
| ل ا           |        |                  | 1        |   |            |                                      |
| 25            |        |                  |          |   |            | ]                                    |
| <u>ا ـــا</u> |        |                  |          |   | L          |                                      |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAME      | ORTHO CHEVRON  | PROJECT NO. S81-5                          |
|-------------------|--|--|
| OWC-11            | PROJECT LOCATION ST. LOUIS, MISSOURI   | DATE 1/27/81<br>RIG CME-750                |
| SURFACE ELEVATION | LOGGED BY Peter Barrett DRILLED BY G. Johanning 524 ELEVATION DATUM USC & GS | WATER ENTERS 503.5 ATD<br>El 514 24 hrs AD |

| DEPTH    |      | AMPLE    |          |  | <del>,</del> | SPECIAL NOTES AND                    |
|----------|------|----------|----------|--|--------------|--------------------------------------|
|          | TYPE | REC      | RESIST   | DESCRIPTION  | U.S.C.       | SPECIAL NOTES AND FIELD OBSERVATIONS |
| 25 –     | С    | 12<br>14 | Р        | SAME: Stiff, brown, low-medium plastic, Silty CLAY           | CL           |                                      |
|          | -    |          | <b>-</b> | Becoming more plastic Stiff, brown, highly plastic CLAY with | СН           | Residual                             |
|          |      |          |          | rock fragments and trace silt                                |              | _                                    |
| 4        |      |          |          | <u> </u>   | 4            | _                                    |
| 30-      | С    | 10       | P        | Becoming gray and brown, very highly                         | 1            | <del></del>                          |
| 4        |      | 10<br>14 | r        | plastic, weathered sandstone stringer                        |              | _                                    |
| 4        | '    | i        |          | -  | }            | _                                    |
| $\dashv$ |      |          |          | _  | 1            | -                                    |
| +        |      |          |          | <del>-</del>   | 1            | -<br>Auger refusal                   |
| 35       | S    | 0        | 30/1"    | LIMESTONE  | LS           | Bottom of Boring                     |
| _        |      | 1        |          | -  | -            | 35.0 ft _                            |
|          |      |          |          | <del>-</del>   | 1            | _                                    |
|          |      | '        |          | <del>-</del>   |              | _                                    |
|          |      |          |          |  | ]            | _                                    |
|          |      |          |          |  |              | _                                    |
| _        |      |          |          |  |              | _                                    |
| 4        |      | :        |          |  | 1            | _                                    |
| _        |      |          |          |  |              | _                                    |
| 4        |      |          |          |  | }            | _                                    |
| 4        |      |          |          | <u>-</u>   |              | _                                    |
| 4        |      |          |          |  |              | _                                    |
| $\dashv$ |      |          |          | <u>.</u>   | 1            | _                                    |
| 4        |      |          |          |  |              | -                                    |
|          |      |          |          | WOODWARD-CLYDE CONSULTANTS                                   | <b></b>      | FIGURE NO A-57                       |

WOODWARD-CLYDE CONSULTANTS

| PROJECT | NAME      | ORTHO CHEVR                     | ON   | PROJECT NO. | OF2<br>                              |
|---------|-----------|---------------------------------|--|-------------|--------------------------------------|
| (       | OWC-12    | PROJECT LOCATION                | ST. LOUIS, MISSOURI                        | DATE        | 2/20/81<br>CME-750                   |
| SURFACE | ELEVATION | LOGGED BY W. Prosser 524 ELEVAT | DRILLED BY G. Johanning ION DATUM USC & GS | WATER ENTE  | ERS <u>El 503.5 A</u> TD<br>H hrs AD |

| SURFAC | CE ELE    | VATION       |        |   | ELEVATION DATUMUSC & GS  |          |             | 1 514 24 HIS AU   |                |
|--------|-----------|--------------|--------|---|--|----------|-------------|---|----------------|
| DEPTH  | S<br>TYPE | AMPLE<br>REC | RESIST |   | DESCRIPTION  |          | U. S. C.    | SPECIAL NOTES AND FIELD OBSERVATIONS                                      |                |
|        |           |              |        | - | 3 inch asphalt Firm to stiff, brown and gray, silty Clay FILL, with asphalt and concrete fragments | 1 1 1 1  | F<br>1<br>L | Boring advanced with 6-inch diameter hollow stem auger, Lower 5 ft 8-inch | 1. 1. 1. 1. 1. |
| 5      |           |              |        | - |  | -        |             |   |                |
| 1      |           |              |        | _ | Stiff, gray, Silty CLAY  |          | CL          | Stream deposit  | 1              |
| _      |           |              |        | _ | Stiff, brown, Silty CLAY with organics   | -        | <b>-</b>    | Some odor   | _              |
| 10     |           |              |        |   |  |          |             | _₩ 24 hr AD   |                |
| -      |           |              |        | - |  | _        |             | Modified loess  | 4              |
| -      |           |              |        | - |  |          |             |   | 1              |
| -      |           |              |        | _ | Becoming firm to stiff, and low to medium plastic  |          |             |   | 4              |
| 15     |           |              |        |   |  |          |             |   |                |
| -      |           |              |        | _ |  | -        |             |   |                |
| -      |           |              |        | F |  | 4        |             |   |                |
| 20     |           |              |        |   |  | _        |             | ATD   | $\exists$      |
|        |           |              |        | - |  | $\dashv$ |             |   | -              |
|        |           |              |        | _ | Stiff to hard, multicolored, highly plast CLAY with some silt and rock fragments                   | tic      | СН          |   | 1              |
| 25     |           |              |        | _ |  | -        |             |   | -              |
|        |           |              |        |   | WOODWARD-CLYDE CONSULTANTS   |          | ·           | FIGURE NO. A-58   |                |

| PROJECT NAME        | ORTHO CHEN                        | /RON                 | SHEET2<br>PROJECT N         |                    |  |
|---------------------|-----------------------------------|----------------------|-----------------------------|--------------------|--|
| OWC - 12            | PROJECT LOCATION                  | ST. LOUIS, MISSOURI  | DATE<br>RIG                 | 2/20/81<br>CME-750 |  |
| SURFACE ELEVATION _ | LOGGED BY W. Prosser<br>524 ELEVA | WATER EN<br>El 514 2 | TERS El 503.5 /<br>24 hr AD | ATI                |  |

| DEPTH   SAMPLE   DESCRIPTION   U.S.C   SPECIAL NOTES AND FIELD OBSERVATIONS |       | EVALION               | ELEVATION DATUM 330 0 US   |          |   |
|---|-------|-----------------------|--|----------|---|
| SAME: Stiff, multicolored, highly plastic CLAY                              | 7405  | SAMPLE<br>TREC TRESIS | DESCRIPTION  | U. S. C. | SPECIAL NOTES AND FIELD OBSERVATIONS  |
|   | DEPTH | 8AMPLE   REC   RESIS  | DESCRIPTION  SAME: Stiff, multicolored, highly plastic CLAY  LIMESTONE: Light gray, slightly weathered with horizontal | сн<br>-  | Boring continued with NX core barrel, diamond bit and water  Run #1 Start: 32.3' Stop: 37.3 Rec: 100% DWR: 80%  Run #2 Start: 37.3' Stop: 40.3' Rec: 100% DWR: 100% |

|        |          |                |            |          |  |   |          | EETOF1                                  |
|--------|----------|----------------|------------|----------|--|---|----------|---|
| PROJEC | CT NAM   | E              |            |          | ORTHO CHEVRON  |   | _ PR     | ROJECT NO. <u>\$81-5</u>                |
|        | OWC-1    | 3              |            | )        | CT LOCATION ST. LOUIS, MISSOURI                      |   | DA       | 2/5/81<br>G CME-750                     |
| L      |          |                | [_         | GGE      | D BY Peter Barrett DRILLED BY G. Johanning           |   |          | ATER ENTERS ET 510 ATD                  |
| SURFAC | CE ELE   | VATION         |            | 16       | ELEVATION DATUM USC & GS                             |   | -<br>    |   |
| DEPTH  | TYPF     | AMPLE          | RESIST     | -        | DESCRIPTION  |   | U. S. C. | SPECIAL NOTES AND FIELD OBSERVATIONS    |
| 0 -    |          |                |            |          | Firm to stiff, brown and gray silty                  |   |          | Boring advanced with                    |
| -      | 1        | İ              |            | F        | Clay FILL  | - |          | 6-inch diameter —<br>hollow stem auger, |
| -      | С        | 8              | P          | +        |  | _ | L        | Lower 5 ft, 8-inch -                    |
| -      |          | 18             |            | -        |  | _ |          | With odor                               |
|        |          |                |            |          | Firm to stiff, gray, low plastic CLAY                | - | CL       | Clay stained bright—                    |
| 5      | С        | 16<br>18       | Р          |          | with organics  |   |          | purple<br>Stream deposit                |
|        | <u> </u> | <del> </del>   | <b> </b> - | 匚        |  |   |          | ATD                                     |
|        | С        | 8              | Р          | T        | Firm to stiff, brown to gray, low                    | - |          | -                                       |
| -      |          | 18             |            | <u> </u> | plastic, Silty CLAY with organics and iron stain     | _ |          | -                                       |
| -      | С        | 12             | P          | ╁        |  | _ |          | Modified loess                          |
| _      | ັ        | 18             |            | L        |  |   |          | - Houtifed foess                        |
| 10_    |          |                |            |          |  |   | i        |   |
|        | С        | <u>8</u><br>18 | P          |          |  |   |          |   |
| -      |          |                |            | <u> </u> |  | _ |          | _                                       |
| -      |          |                |            | <b> </b> |  | _ |          | _                                       |
| -      |          |                |            | H        |  | _ |          |   |
| _      |          | 1              |            |          |  | _ |          | _                                       |
| 15     |          |                |            |          |  |   |          |   |
|        | С        | 18<br>18       | Р          |          | Becoming more plastic                                |   |          | Some odor                               |
|        | ļ        | 10             |            |          |  |   |          | _                                       |
| -      |          |                |            | <b> </b> |  | - |          | -                                       |
| -      | }        |                | l          | H        |  | _ |          | <del>-</del>                            |
|        |          |                |            |          |  | _ |          | _                                       |
| 20     |          |                |            | L        |  |   |          |   |
|        | С        | 15<br>18       | Р          |          | Stiff, tan, highly plastic CLAY with shale structure |   | СН       | Residual                                |
|        |          |                |            | Γ        |  |   |          | Bottom of Boring                        |
|        |          |                |            | r        |  | 1 |          | 2 1.5 ft -                              |
| -      |          |                |            | H        |  | - |          | -                                       |
| -      |          |                |            | -        |  | - |          | -                                       |
| l 25   |          |                | ļ          | l        |  |   |          |   |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAM | ME      | ORTHO            | CHEVRON   |               |           | PROJECT NO. | OF'<br>\$81-5     |
|-------------|---------|------------------|-----------|---------------|-----------|-------------|-------------------|
| OWC-14      | , 7     | PROJECT LOCATION |           | ST. LOUIS,    |           | DATE        | 2/6/81<br>CME-750 |
|             |         | LOGGED BY Peter  |           | DRILLED BY G. | Johanning | WATER ENTE  |                   |
| SURFACE EL  | EVATION | 512              | ELEVATION | DATUMUS       | SC & GS   | Detected    | ATD               |

| SURFAC | CE ELE   | VATION   |                 |            | ELEVATION DATUM USL & GS                                  |        | Detected ATD   |
|--------|----------|----------|-----------------|------------|---|--------|--|
| DEPTH  | -        | SAMPLE   |                 |            | DECORDATION   |        | SPECIAL NOTES AND  |
| 0_     | TYPE     | REC      | RESIST          | 1_         | DESCRIPTION   | U.S.C. | FIELD OBSERVATIONS   |
| _      | C        | 10<br>18 | P               | -          | Firm to stiff, brown, Clay FILL                           | FILL   | Boring advanced with 6-inch diam- eter hollow stem auger, Lower 5 ft |
| _      |          |          |                 |            | Stiff, brown, becoming gray at base, low                  | CL     | 8-inch<br>Some odor  |
| _      | С        | 13<br>18 | Р               | -          | plastic Silty CLAY with iron deposits -                   |        | Stream deposit -   |
| ا ہا   | <u> </u> | -        |                 | 1          |   | ł      |  |
| 5      | С        | 12<br>18 | Р               |            |   |        | _  |
|        |          |          |                 | 十          | Stiff, brown to tan, medium plastic                       | 1      | Modified loess   |
|        | С        | 13<br>18 | Р               |            | Silty CLAY  |        |  |
| •      |          |          |                 | ł          |   | 1      |  |
| -      | ĺ        |          |                 | H          | -   | 1      | -  |
| 10     |          |          |                 | <u> </u> _ | <u> </u>  | ]      |  |
|        | С        | 15<br>18 | Р               | _          | Becoming more silty                                       |        | _  |
| _      |          |          | Ļ <del></del> - | -          | <del>-</del>  | }      | _  |
| -      |          |          |                 | F          | -   | -      | -  |
| -      |          | :        |                 | -          | _   |        | -  |
| 15     | С        | 13<br>18 | Р               |            |   |        | . —  |
| -      |          | 18       |                 |            | <del>-</del>  |        | _  |
| -      |          |          |                 | <b> </b>   | <del>-</del>  | 1      | -  |
|        |          |          |                 | ļ.         | -   |        | _  |
| -      |          |          |                 | _          | Hard, tan-brown, highly plastic CLAY with shale fragments | СН     | Residual _   |
| 20_    |          |          |                 | <u> </u>   |   | 1      |  |
|        | С        | 12<br>18 | Р               | L          | _   |        | _  |
| _ ]    |          |          |                 | L          | _   |        |  |
|        | С        | 12<br>18 | Р               |            |   |        |  |
| ]      |          |          |                 | }          |   |        | Dathar of Davis  |
| 25_    |          |          |                 | _          | <del>-</del>  |        | Bottom of Boring _<br>23.5 ft  |
|        |          |          |                 |            |   |        |  |

WOODWARD-CLYDE CONSULTANTS

| PROJECT NAME      | ORTHO CHEVRON  | PROJECT NO. S81-5          |
|-------------------|--|----------------------------|
| 0WC-15            | ST. LOUIS, MISSOURI  | DATE 2/6/81<br>RIG CME-750 |
|                   | PROJECT LOCATION ST. ED013, MISSORY  LOGGED BY Peter Barrett DRILLED BY G. Johanning | WATER ENTERSE 1 500 ATD    |
| SURFACE ELEVATION | ELEVATION DATUM USC & GS   |                            |

| DEPTH | S    | AMPLE           |        | DESCRIPTION   | U. S. C | SPECIAL NOTES AND   |
|-------|------|-----------------|--------|---|---------|---|
| 0 -   | TYPE | REC             | RESIST | DEGULATION  | _       | FIELD OBSERVATIONS  |
|       |      |                 |        | Firm to stiff, brown, Silty CLAY                                  | CL      | Boring advanced with 6-inch diameter - hollow stem auger; |
| -     | С    | 10<br>18        | P      | -   | -       | Lower 5 ft, 8-inch - Modified Loess                       |
| -     |      | 18              |        | -   | 1       | _   |
| 5     |      |                 |        | <del>-</del>  | 1       | -   |
| 7     | С    | 13              | P      | <del>-</del>  | 7       |   |
| -     |      | 13<br>18        |        | -   | -       | -   |
| _     |      |                 |        |   | +       | -   |
| -     |      |                 |        | <del>-</del>  | 1       | -   |
| 10    |      |                 |        | <b>-</b>  | -       | -   |
| 10    | С    | 13<br>18        | Р      | Becoming medium plastic   |         | _   |
| -     |      | 18              |        |   | 1       | -   |
| _     |      | i               |        |   |         | -   |
| -     |      |                 |        |   |         | ATD   |
| 15    |      |                 |        | Stiff, brown, highly plastic CLAY                                 | СН      |   |
|       | С    | <u>17</u><br>18 | Р      | <del>-</del>  |         |   |
|       |      |                 |        | _   |         | _   |
|       | j    |                 |        |   |         |   |
| ]     |      |                 |        | Hard, tan and gray, highly plastic CLAY<br>— with shale fragments |         | Residual  |
| 20_   |      |                 |        |   |         | <u></u>   |
|       | С    | 9<br>18         | Р      | _   |         | _   |
| 1     |      |                 |        | <u>                                     </u>                      |         | Bottom of Boring  |
| 4     |      |                 |        | !<br><del>-</del>   | _       | -   |
| 4     |      | ł               |        |   | _       | -   |
| 25    |      |                 |        | <del></del>   |         |   |
|       |      |                 |        | WOODWARD-CLYDE CONSULTANTS  |         | FIGURE NO. A-62   |

APPENDIX B

WELL PROFILES

| Project         |  |        | · ·  |                    | LOUIS, MISSOURI   |
|-----------------|--|--------|--|--------------------|---|
| Project         | No. S81-5 Installed By                                     | W.C    | .C.  | Date <u>2-18-8</u> | Time  |
|                 | of Installation Well screen and ri                         |        |  |                    |   |
| auge            | rs were removed from the boring.                           | Dr     | illing fluid wa  | s not require      | ed  |
|                 |  |        |  |                    |   |
|                 |  |        |  | <del> </del>       |   |
|                 | LOG OF BOF   | RING   | AND PIEZOME  | ETER               |   |
|                 |  |        |  | PIEZOMET           |   |
|                 | BORING   |        | Type of Piezomet   | er PVC Observ      | vation Well   |
|                 |  | 1 =    | ·  |                    |   |
| Depth<br>in ft. | Description  | Symbol | Ground Elev. 51  | 1 TO               | op of Riser Elev. 543.7<br>(Protective Casing)<br>Vented Cap  |
| - 0 -<br>       | Firm to stiff, brown, low plastic, Silty CLAY              | CL     |  |                    | L.D. of Riser Pipe 4''  Type of Pipe PVC  |
| -10 -           | Becoming medium plastic                                    |        | $ \begin{array}{c c} L_{1} = 2 \cdot 2^{1} \\ L_{2} = 7 \cdot 5^{1} \\ L_{3} = 3 \cdot 0^{1} \\ L_{4} = 12 \cdot 5^{1} \\ L_{5} = 10^{1} \end{array} $ | L <sub>2</sub>     | Type of Backfill Around Riser <u>Cement</u> - Bentonite Grout  Top of Seal Elev. <u>533.5</u> Type of Seal Material Peltonite |
| -15<br><br>     | Hard, tan-brown, highly plastic<br>CLAY with trace of silt | СН     | L <sub>7</sub> =23'  |                    | Top of Filter Elev. 530.5  Type of Filter Material  Washed River Sand  Size of Openings 0.02''                                |
| -20 -<br>-      | Becoming multi-colored, with shaley sections               |        | Le   |                    | Diameter of Piezometer Tip4''   |
| r 1             |  |        | <u> </u>   | T T                | Bottom of Piez. Elev. 518   |
| -25 -           |  |        |  |                    | Bottom of Boring Elev. 518 Diameter of Boring 8'1   |
| Remark          | s Bottom of boring: 23'                                    |        |  |                    |   |
|                 |  |        |  | <del></del>        |   |

Inspected By Peter Barrett

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| Project No. S81-5  Method of Installation  | core barrel. Water wa   | be c<br>s no<br>pipe | Piezometer No. OWC - 2  Location ST. LOUIS, MISSOURI  Date 2-17&18-81 Time  ore barrel used to core limestone. Clean water trecirculated. Screen is 10 ft of hacksaw-were installed after core barrel was removed.  AND PIEZOMETER  PIEZOMETER  Type of Piezometer PVC Observation Well  |
|--|---|----------------------|--|
| Depth in ft.   | Description   | Symbol               | Ground Elev. 541 Top of Riser Elev. 542.3  (Protective Casing)  Vented Cop   |
| Hard, tan- CLAY with  Becoming m  Becoming g  Hard, tan- CLAY with  Becoming g  LIMESTONE SHALE: Cal  Becoming g  LIMESTONE: unweathere at the top | brown, highly plastic trace of silt multi-colored, shaley gray with fine sand careous, gray  Massive, light gray, ed with 4' of quartz (with pyrite cube) | CH<br>CH<br>SH<br>LS | I.D. of Riser Pipe 1.5"  Type of Pipe PVC  Type of Backfill Around Riser Cement - Bentonite Grout  Top of Seal Elev. 486.0  Type of Seal Material Peltonite  Top of Filter Elev. 483.5  Type of Filter Material Washed River Sand  Size of Openings 0.02"  Diameter of Piezometer Tip 1.5"  Bottom of Piez. Elev. 471.5  Bottom of Boring Elev. 471.5  Diameter of Boring 6"; 3' |

Peter Barrett

WOODWARD-CLYDE CONSULTANTS

inspected By\_\_

| Project           | ORTHO-CHEVRON  |          | Piezometer No. OWC - 3 Location ST. LOUIS, MISSOURI   |
|-------------------|--|----------|---|
| Project<br>Method |  |          | pipe were installed immediately after augers  |
| were              | removed from the boring. Drill                             | ing      | fluid was not required.   |
|                   | LOG OF BOR   | RING     | AND PIEZOMETER  |
|                   | BORING   |          | PIEZOMETER  Type of Piezometer PVC Observation Well   |
| Depth<br>in ft.   | Description  | Symbol   | Ground Elev. 529 Top of Riser Elev. 532 (Protective Casing) Vented Cop                          |
| - 0 <del>-</del>  | Firm to stiff, brown, Silty<br>Clay FILL                   | FILL     | 1.D. of Riser Pipe 4''  |
| -10 -             | Stiff, brown, low to medium plastic, Silty CLAY            | CL       | Type of Pipe PVC  Type of Backfill Around Riser Cement - Bentonite Grout  Top of Seal Elev. 519 |
| -20 -             | Hard, brown, highly plastic<br>CLAY<br>Becoming light gray | СН       | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| - 30 -<br>-<br>-  | Stiff, purple, highly plastic CLAY                         | CH<br>LS | Top of Filter Elev. 516  Type of Filter Material  Washed River Sand  Size of Openings 0.02"     |
| -40 -             |  |          | Diameter of Piezometer  Tip 4"  |
|                   |  |          | Bottom of Piez. Elev. 494  Bottom of Boring Elev. 494  Diameter of Boring 8''                   |
| Remark            | Bottom of boring: 35'                                      |          |   |
|                   |  |          |   |

Peter Barrett

WOODWARD - CLYDE CONSULTANTS

Inspected By\_

|                 | 1 12201412 12   | 1 1 11        | NOTALLATION NI  | _FORT   |
|-----------------|---|---------------|---|---|
| Method          | ORTHO-CHEVRON  No. S81-5 Installed By of Installation Well screen and ring removed from the boring. Drill | ser           | .C. Do  |   |
|                 | LOG OF BOI  | RING          | AND PIEZOMETE   | D   |
|                 | BORING  | VIIVO         |   | PIEZOMETER PVC Observation Well                           |
| Depth<br>in ft. | Description   | Symbol        | Ground Elev. 519  | Top of Riser Elev. 521.4  (Protective Casing)  Vented Cap |
| - 0 -           | Firm to stiff, brown, low plastic Clay FILL   | FILL          |   | I.D. of Riser Pipe 4"                                     |
| -               | Stiff, brown, low to medium plastic, Silty CLAY   | CL            | L <sub>2</sub>  | Type of Pipe PVC  Type of Backfill Around                 |
| -10 -           | Becoming more plastic   | CL<br>I<br>CH | L <sub>5</sub>  | Riser Cement - Bentonite Grout  Top of Seal Elev. 513.5   |
|                 | Hard, tan to brown, highly plastic CLAY with black iron stains Becoming brown and purple                  | СН            | $ \begin{array}{c c} L_{1} = 1.9' \\ L_{2} = 5.5' \\ L_{3} = 3' \\ L_{4} = 21' \\ L_{5} = 11.4' \end{array} $ | Type of Seal Material                                     |
| - 30 -          |   |               | L <sub>6</sub> =20'<br>L <sub>7</sub> =29.5'  | Top of Filter Elev. 510.5  Type of Filter Material        |
|                 |   |               | •   | Bottom of Piez. Elev. 489.5  Bottom of Boring Elev. 489.5 |
|                 |   |               |   | Diameter of Boring 8"                                     |

Remarks\_

Bottom of boring: 29.5' (Auger Refusal)

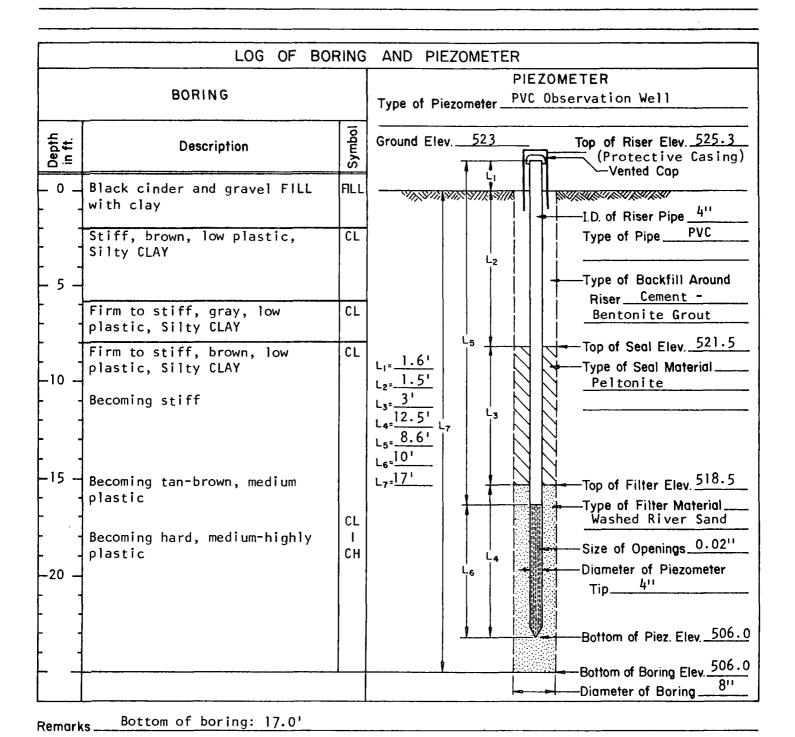
Inspected By Peter Barrett

WOODWARD-CLYDE CONSULTANTS

|                 |  |            | Piezometer No. OWC - 5   |  |  |  |  |  |  |
|-----------------|--|------------|--|--|--|--|--|--|--|
| Project         |  | <u>,</u>   | Location ST. LOUIS, MISSOURI   |  |  |  |  |  |  |
| Project         | NoS81-5 Installed By                                     | W.(        | C.C. Date 2-5-81 Time  |  |  |  |  |  |  |
| Method          | of Installation Well screen and ri                       | ser        | pipe were installed immediately after augers                                 |  |  |  |  |  |  |
| _were           | removed from boring. Drilling                            | flui       | id was not required.   |  |  |  |  |  |  |
|                 |  |            |  |  |  |  |  |  |  |
|                 |  |            |  |  |  |  |  |  |  |
|                 | LOG OF BOF   | RING       | S AND PIEZOMETER   |  |  |  |  |  |  |
|                 | BOBING   |            | PIEZOMETER   |  |  |  |  |  |  |
|                 | BORING   |            | Type of Piezometer PVC Observation Well                                      |  |  |  |  |  |  |
| Depth<br>in ft. | Description  | Symbol     | Ground Elev. 515 Top of Riser Elev. 518.1 (Protective Casing)                |  |  |  |  |  |  |
| - 0 -           | Stiff, brown, Clay FILL                                  | FILL       | 1  |  |  |  |  |  |  |
| -               |  |            | I.D. of Riser Pipe 4''   |  |  |  |  |  |  |
|                 | Stiff, gray, low plastic,<br>Silty CLAY<br>Becoming hard | CL         | Type of Pipe PVC   |  |  |  |  |  |  |
| -10 -           | Becoming brown and gray, medium plastic                  |            | Type of Backfill Around Riser Cement - Bentonite Grout                       |  |  |  |  |  |  |
| -20 -           | Becoming light brown and gray, stiff, more silty         |            | Top of Seal Elev. 506  |  |  |  |  |  |  |
|                 | Medium-highly plastic with purple shale fragments        | C L<br>C H | L <sub>2</sub> = 9' L <sub>3</sub> = 13' L <sub>4</sub> = 13' L <sub>7</sub> |  |  |  |  |  |  |
| <br>- 30 -      | Hard, yellow-brown, highly<br>plastic                    | СН         | $L_{5} = \frac{17.5'}{16}$ $L_{6} = \frac{10'}{26.5'}$                       |  |  |  |  |  |  |
|                 |  |            |  |  |  |  |  |  |  |
| }               |  |            | Type of Filter Material Washed River Sand                                    |  |  |  |  |  |  |
|                 |  |            | Size of Openings 0.02"   |  |  |  |  |  |  |
|                 |  |            | L4   Diameter of Piezometer  |  |  |  |  |  |  |
|                 |  |            | Tip  |  |  |  |  |  |  |
| - 1             |  |            | Bottom of Piez. Elev. 490  |  |  |  |  |  |  |
| -<br>-          |  |            | Bottom of Boring Elev. 488.5   |  |  |  |  |  |  |
| Ll              |  |            | Diameter of Boring 8'1   |  |  |  |  |  |  |
| Remark          | s Bottom of boring: 26.2' (A                             | Auge       | er Refusal)  |  |  |  |  |  |  |
|                 |  |            |  |  |  |  |  |  |  |
|                 |  |            |  |  |  |  |  |  |  |

|                   |   |          |  | Piezometer No. OWC - 6                             |
|-------------------|---|----------|--|--|
|                   | ORTHO-CHEVRON                               |          |  | Location_ST. LOUIS, MISSOURI                       |
| Project           | No. S81-5 Installed By _                    | W.C      |  | Date <u>2-2-81</u> Time                            |
| Method            | of InstallationThis boring caved            | pric     | or to setting  | well screen. Clean water was                       |
|                   |   |          |  | water was not recirculated. Well                   |
| scre              | en and riser pipe were installed            | i mn     | nediately afte   | r the boring was flushed.                          |
|                   |   |          |  |  |
|                   | LOG OF BOR                                  | RING     | AND PIEZOI   | METER  |
|                   |   |          |  | PIEZOMETER   |
|                   | BORING                                      |          | Type of Piezom   | neter PVC Observation Well                         |
| <del></del>       |   | Т        |  |  |
| Depth<br>in ft.   | Description                                 | Symbol   | Ground Elev  |  |
| a e               | •   | Sy       | T  | (Protective Casing) Vented Cop                     |
| _ 0 _             | Firm to stiff, brown CLAY Fill              | FILL     |  | 6'   |
| -                 | with gravel                                 |          |  | I.D. of Riser Pipe 4"                              |
| <b>}</b> -        | Firm to stiff, brown, low to                | CL       |  | Type of Pipe PVC                                   |
| <b>†</b>          | medium plastic, Silty CLAY                  |          |  | L <sub>2</sub>                                     |
| 10 -              | with rootholes and voids                    |          |  | Type of Backfill Around                            |
|                   |   |          |  | Riser Cement -                                     |
|                   |   |          |  | Bentonite Grout                                    |
| -                 | Becoming medium plastic                     |          |  | Top of Seal Elev. 519                              |
| -                 |   |          | L <sub>1</sub> = 1.6'  | Type of Seal Material                              |
| <b>⊢</b> 20 −     | Stiff, brown, highly plastic                | СН       | L2=41  | Peltonite  |
| <u> </u>          | CLAY with silt                              |          | L <sub>3</sub> =31<br>L <sub>4</sub> =181<br>L <sub>4</sub> =-L <sub>7</sub> | L <sub>3</sub> N                                   |
| <u> </u>          | Hard, vari-colored with shale and fine sand |          | L4=18' L7  | Ī NN   |
|                   |   |          | L5= 9.6'   |  |
| _30 _             |   |          | L <sub>6</sub> =17'  | - 4 - 516  |
|                   |   |          | L7=3:2-  | Top of Filter Elev. 516                            |
|                   |   |          |  | Type of Filter Material<br>Washed River Sand       |
| + -               |   |          |  | Size of Openings 0.02"                             |
| <b>†</b> 1        |   |          | <u> </u>   | [4] [2] [3] [4] [4] [4] [4] [4] [4] [4] [4] [4] [4 |
|                   |   |          | ]  | Tip4''   |
|                   |   |          |  |  |
|                   |   |          |  | Bottom of Piez Elev. 498                           |
| }                 |   |          |  | BOHOM OF PIEZ. CIEV. 450                           |
| $\vdash$ $\dashv$ |   | <u> </u> |  | Bottom of Boring Elev. 496.5                       |
|                   | ·   |          |  | Diameter of Boring 811                             |
| Remark            | s Bottom of boring: 26.2'                   |          |  |  |
| vemar k           | 3 201 201 111g. 2012                        |          | <del></del>  |  |
|                   | <del></del>                                 |          |  |  |

| Project    | ORTHO-CHEVRON                                  | Piezometer No     |  |  |
|------------|--|-------------------|--|--|
| •          | -  | Date 2-18-81 Time |  |  |
|            | allation Well screen and riser pipe were insta |                   |  |  |
| augers wer | e removed from the boring. Drilling fluid wa   | s not required.   |  |  |



Peter Barrett

WOODWARD -- CLYDE CONSULTANTS

Inspected By-

| Description    Second Elev. 523   Top of Riser Elev. 525.7   | flusi                                      | No. <u>\$81-5</u> Installed By of Installed installation This boring caved hed by pumping clean water through  | or to setting well screen. The boring well screen. The water was not reciped immediately after flushing the boring | vas<br>culated.   |  |
|--|--|--|--|---|--|
| - 0 Black cinder and gravel FILL with clay  Stiff, brown, low plastic, Silt CL  Silty CLAY  Firm-stiff, gray, low plastic, CL  Silty CLAY  Firm-stiff, brown, low plastic, Silt CL  Silty CLAY  Becoming stiff  Becoming tan-brown, medium plastic  Stiff-hard, tan-brown, highly plastic  Stiff-hard, tan-brown, highly plastic CLAY with trace of silt  -30  Size of Openings 0.02!'  Bottom of Piez, Elev. 495.5  Bottom of Piez, Elev. 495.5  Diameter of Boring Elev. 495.5  Diameter of Boring Elev. 495.5 | Depth<br>in ft.                            | Description  | Symbol   | Ground Elev. 523 Top of Riser Ele   | e Casing)  |
| Remarks Bottom of boring: 27.5'  | - 0 -<br>- 10 -<br>- 20 -<br>- 30 -<br>- 3 | Stiff, brown, low plastic, Silt Silty CLAY Firm-stiff, gray, low plastic, Silty CLAY Firm-stiff, brown, low plastic, Silty CLAY Becoming stiff  Becoming tan-brown, medium plastic Becoming hard, medium-highly plastic  Stiff-hard, tan-brown, highly plastic CLAY with trace of silt | CL<br>CL<br>CL<br>CH   | Type of Pipe  Type of Backfi Riser Cement Bentonite  Top of Seal Ele  Type of Seal M Peltonite  Top of Filter El  Type of Filter I Washed Rive  Size of Opening Diameter of Pie Tip  Bottom of Boring | PVC  II Around Frout  Strout  V. 509.5  Atterial  Example 20.02"  Example 20.02"  Example 20.02"  Example 20.02"  Example 20.02"  Example 20.02" |

|                | No. S81-5 Installed By of Installation Well screen and ri removed from the boring. Drill   | ser           | pipe were installed immediately after augers fluid was not required.   |                   |
|----------------|--|---------------|--|-------------------|
|                | BORING   |               | Type of Piezometer PVC Observation Well  | _                 |
| O in ft.       | Description  Stiff, gray, Silty Clay FILL with cinders and organics Stiff, gray, Silty CLAY with organics Stiff, brown, low plastic, | L Cr Cr       | Ground Elev. 532  Top of Riser Elev. 534.8  (Protective Casing)  Vented Cap  I.D. of Riser Pipe 4''  Type of Pipe PVC          | <del>-</del><br>- |
| -10            | Very stiff, red-brown, highly plastic CLAY  Becoming brown with black iron deposits  | СН            | Type of Backfill Around Riser Cement - Bentonite Grout  Top of Seal Elev. $525.5$ Type of Seal Material Peltonite              |                   |
| -30 -<br>-40 - | Hard, gray-brown, CLAY with fine sand and shale fragments  Becoming orange-brown, very shaley  LIMESTONE                             | CH<br>I<br>SH | Top of Filter Elev. 522.5  Top of Filter Material  Washed River Sand  Size of Openings 0.02''  Diameter of Piezometer  Tip 4'' | -                 |
| Femark         |  |               | Bottom of Piez. Elev. 500  Bottom of Boring Elev. 500  Diameter of Boring 8''  |                   |

|        | 601 E   | Dr                     | .C. pipe were instal illing fluid was   | not required.   |
|--------|---|------------------------|---|---|
|        | BORING  |                        | Type of Piezometer  | PIEZOMETER PVC Observation Wells  |
| - 10   | Stiff, brown-gray, highly plastic Clay FILL with organics and bricks  Stiff, gray, low plastic, Silty CLAY  Stiff, brown, low to medium plastic, Silty CLAY  Becoming gray  Stiff to firm, brown and purple, medium to low plastic, Silty CLAY with shale  Firm-soft, multi-colored, highly plastic CLAY with lime-stone and shale fragments  LIMESTONE | 19qm/S F-니 C C C C C C | Ground Elev. 528  L <sub>1</sub> = 1.5' L <sub>2</sub> = 7' L <sub>3</sub> = 3' L <sub>4</sub> = 18' L <sub>7</sub> = 15' L <sub>6</sub> = 15' L <sub>7</sub> = 28' L <sub>7</sub> = 28' L <sub>6</sub> | Top of Filter Elev. 518  Type of Filter Material  Peltonite  Type of Openings 0.02" |
| Remark | S Bottom of boring: 28.0'   |                        |   |   |

P. J. Knotts

WOODWARD - CLYDE CONSULTANTS

Inspected By\_

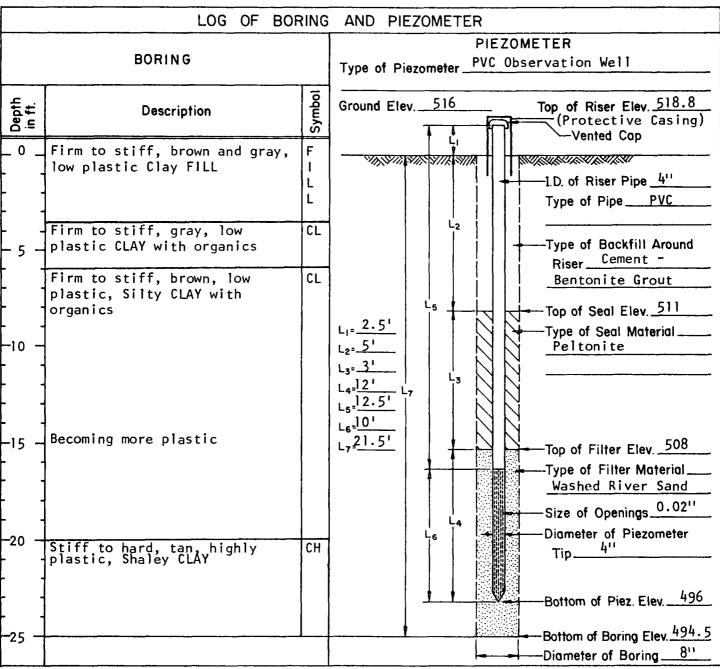
| Project ORTHO-CHEVRON  Project No. S81-5 Installed By Method of Installation Well screen and r were removed from the boring. Dril  LOG OF BO  | iser pipe were i | nstalled immediately after augers ot required.  OMETER   |
|---|------------------|--|
| BORING  | Type of Piez     | PIEZOMETER ometer PVC Observation Well   |
| Description  Stiff, brown, Silty Clay FILL  With rubble  Stiff, gray, low plastic, Silty  CLAY  Stiff, brown, low plastic,  Silty CLAY  Stiff to hard, brown, highly plastic CLAY  John Stiff to hard, brown, highly plastic CLAY | L                | CProtective Casing)   Vented Cap   Vented Cap   I.D. of Riser Pipe 4''     Type of Pipe PVC     Type of Backfill Around     Riser Cement -     Bentonite Grout     Top of Seal Elev. 511.0     Type of Seal Material     Peltonite     Vashed River Sand     Size of Openings 0.02''     Diameter of Piezometer     Tip 4''     Bottom of Piez. Elev. 496     Bottom of Boring Elev. 496     Comment of Piez. Ele |
| Remarks Bottom of boring: 28.0'   |                  | Diameter of Boring 8"  |

Inspected By Peter Barrett

WOODWARD-CLYDE CONSULTANTS

|                 |  |             |  | Piezometer No. OWC - 12                                    |
|-----------------|--|-------------|--|--|
| Project         |  |             |  | Location ST. LOUIS, MISSOURI                               |
| Project         | NoS81-5 Installed By _   | W.C         |  | Date <u>2-20-81</u> Time                                   |
| Method          | of Installation NX-size double tub   | e co        | re barrel was us   | sed to core the limestone.                                 |
| Clear           | n water was used to cool the cor   | e ba        | rrel. The water  | r was not recirculated. Well                               |
| scre            | <mark>en and riser pipe were installed</mark>                              | imm         | ediately after c   | core barrel was removed from                               |
| the I           | boring.  |             |  |  |
|                 | 100 05 00  |             | AND DIFTONE  |  |
|                 | LOG OF BOI   | RING        | AND PIEZOME  | · · · · · · · · · · · · · · · · · · ·                      |
|                 | BORING   |             |  | PIEZOMETER   |
|                 | BORING   |             | Type of Piezomete  | er PVC Observation Well                                    |
| Depth<br>in ft. | Description  | Symbol      | Ground Elev. 524   | (Protective Casing)  |
| 0<br>           | Firm to stiff, brown and gray,<br>Silty Clay FILL                          | F<br>L<br>L | - VINSON VINS SIII.  | I.D. of Riser Pipe 1.5"  Type of Pipe PVC                  |
| _<br>_10 _<br>  | Stiff, brown, low plastic,<br>Silty CLAY<br>Becoming low to medium plastic | CL          |  | Type of Backfill Around Riser Cement - Bentonite Grout     |
| -20 -           | Becoming medium plastic Stiff to hard, multi-colored,                      | СН          | L <sub>1</sub> = 2.0'<br>L <sub>2</sub> =25.25'<br>L <sub>3</sub> = 3'<br>L <sub>4</sub> =12'<br>L <sub>5</sub> 32.25' | Top of Seal Elev. 498.75  Type of Seal Material  Peltonite |
| <br>-30 -       | highly plastic CLAY with trace of silt and rock fragments                  |             | L <sub>6</sub> =10'<br>L <sub>7</sub> =40.25'  | Top of Filter Elev 495.75                                  |
|                 | LIMESTONE: Gray, weathered with horizontal and vertical clay seams         | LS          |  | Type of Filter Material                                    |
| 40<br>          |  |             | L6   | Diameter of Piezometer  Tip1.5"                            |
| 1               |  |             |  | Bottom of Piez. Elev. 483.79                               |
| -<br>50         |  |             |  | Bottom of Boring Elev. 183.7!  Diameter of Boring 6''; 3'  |
| Remark          | Bottom of boring: 40.3'  |             |  |  |
|                 |  | <del></del> |  |  |
|                 |  |             |  |  |

| Project     | ORTHO-CHEVRON                                    | Piezometer No. OWC - 13 Location ST. LOUIS, MISSOURI |  |
|-------------|--|--|--|
| Project No. |  | Date 2-5-81 Time                                     |  |
|             | stallation Well screen and riser pipe were insta |  |  |
| augers we   | re removed from the boring. Drilling fluid was   | s not required.                                      |  |



| Remarks | Bottom of boring: 21.5' |              |   |
|---------|-------------------------|--------------|---|
|         |                         |              |   |
|         |                         | Inspected By | P. J. Knotts woodward-clyde consultants |

|  | 1 12201412 1 21  | <b>\</b> 11 | NOTALLATION  | THE OIL   |
|--|--|-------------|--|---|
|  | No. S81-5 Installed By   | ser         | pipe were insta  | Piezometer No. OWC - 14  Location ST. LOUIS, MISSOURI  Date 2-6-81 Time  Illed immediately after augers required. |
|  | LOG OF BOF   | RING        | AND PIEZOME  | TER   |
|  | BORING   |             | Type of Piezomet   | PIEZOMETER er PVC Observation Well  |
| Depth<br>in ft.                              | Description  | Symbol      | Ground Elev. 51  | 3 Top of Riser Elev. 515 (Protective Casing) Vented Cop   |
| - 0 -<br>- 5 -<br>- 10 -<br>- 15 -<br>- 20 - | Firm to stiff, brown clay FILL  Stiff, brown-gray, low plastic, Silty CLAY  Stiff to hard, brown-tan, low to medium plastic, Silty CLAY  Hard, tan-brown, highly plastic CLAY with shale fragments |             | $ \begin{array}{c c} L_{1} = \underline{1.2}^{1} \\ L_{2} = \underline{6}^{1} \\ L_{3} = \underline{3}^{1} \\ L_{4} = \underline{13}^{1} \\ L_{5} = \underline{13.2}^{1} \\ L_{6} = \underline{10}^{1} \\ L_{7} = \underline{23.5}^{1} \end{array} $ | 9'  |

-Bottom of Piez. Elev. 491

-Bottom of Boring Elev. 489.5 -Diameter of Boring 811

|         | oS81-5 Installed By  | ser       | pipe were installed immediately after augers  |
|---------|--|-----------|---|
|         | LOG OF BOR   | RING      | AND PIEZOMETER  |
|         | BORING   |           | PIEZOMETER  Type of Piezometer PVC Observation Well   |
| P       | Description  irm to stiff, brown, low lastic, Silty CLAY  ecoming more plastic                                 | lodmy2 Cr | Ground Elev. 514  Top of Riser Elev. 516.5  (Protective Casing)  Vented Cap  I.D. of Riser Pipe 4''  Type of Pipe PVC  Type of Backfill Around  Riser Cement -  Bentonite Grout  Top of Seal Elev. 509  Type of Seal Material  Peltonite                                      |
| - ' - m | ery stiff to hard, brown, edium to highly plastic CLAY  ard, tan-gray, highly plastic LAY with shale fragments | СН        | L <sub>3</sub> =12' L <sub>5</sub> =11.8' L <sub>7</sub> =21.5'  Top of Filter Elev. 506  Type of Filter Material Washed River Sand  Size of Openings 0.02''  Diameter of Piezometer  Tip 4''  Bottom of Piez. Elev. 494  Bottom of Boring Elev. 492.  Diameter of Boring 8'' |

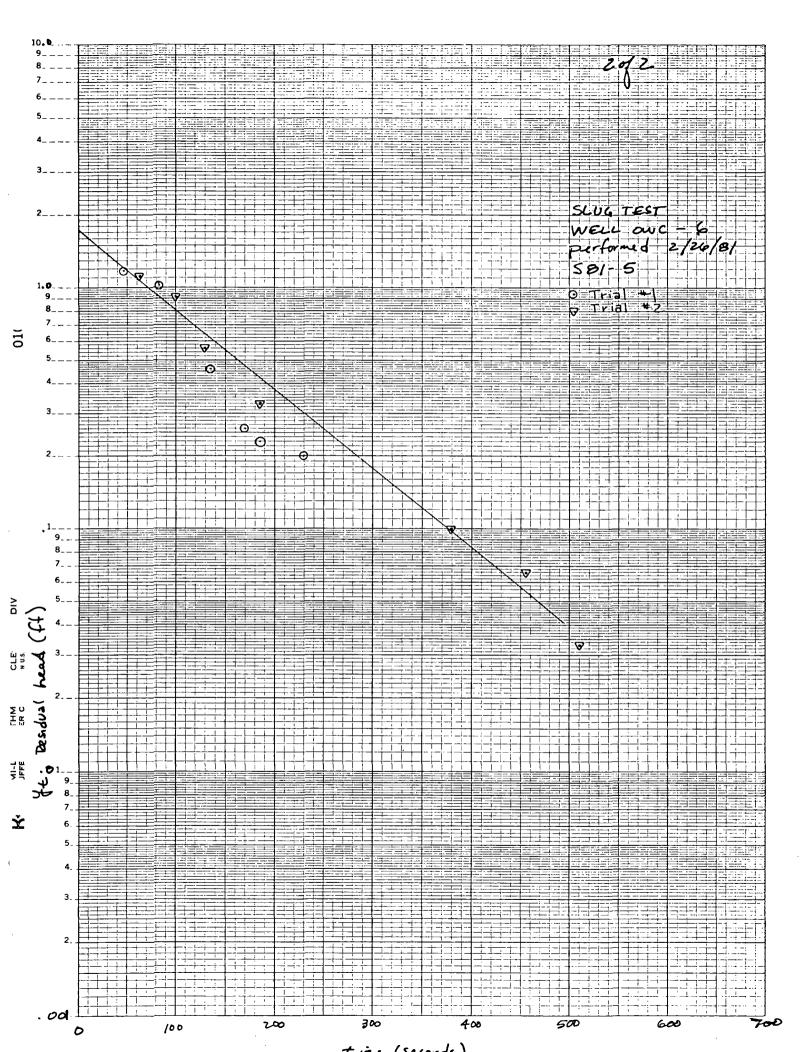
APPENDIX C
SLUG TEST DATA

# Woodward-Clyde Consultants

Problem History Given Assumptions Reasoning Solution Conclusions

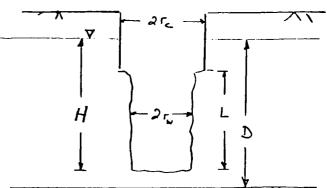
Well DWC-6

DATE **5/29/2** JOB NO.



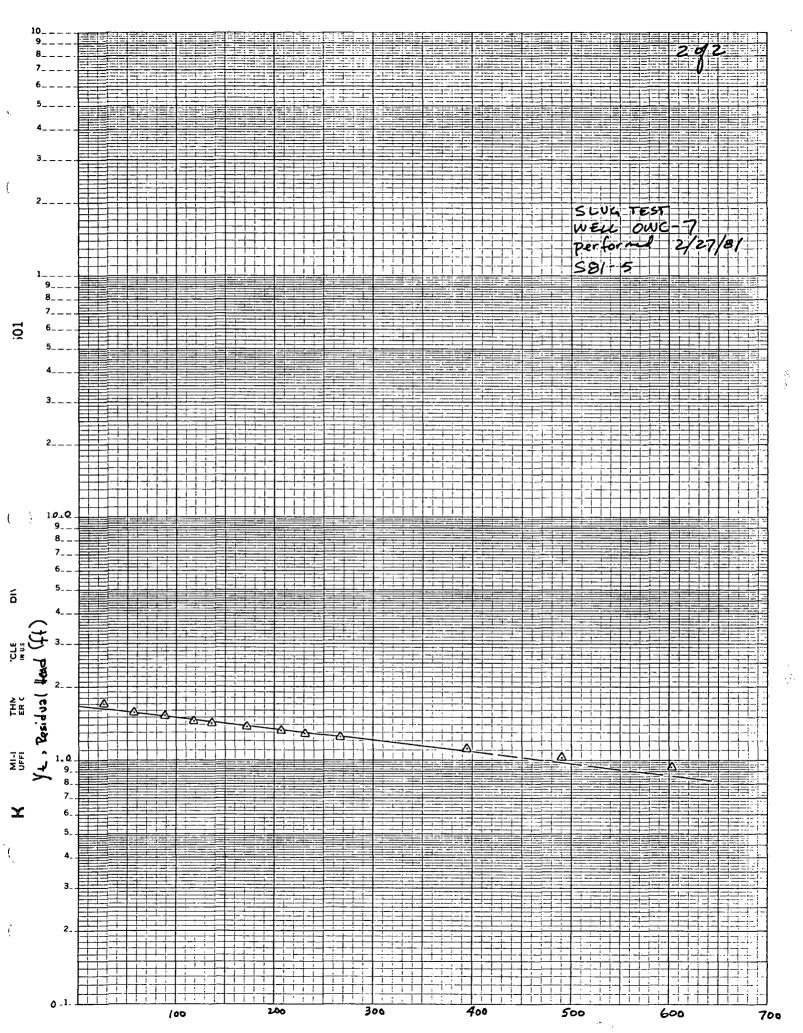
Problem History Given Assumptions Reasoning Solution Conclusions

Well OWC-7



CALC: SLUG TEST UNCONFINED JOB 581-5

DATE 3-3-81 CHKD BY 18



TIME (SECONDS)

Problem History Given Assumptions Reasoning Salution Conclusions

Well OWC-8

Experiments

The 0.323 ft 

Cet=1600 see 

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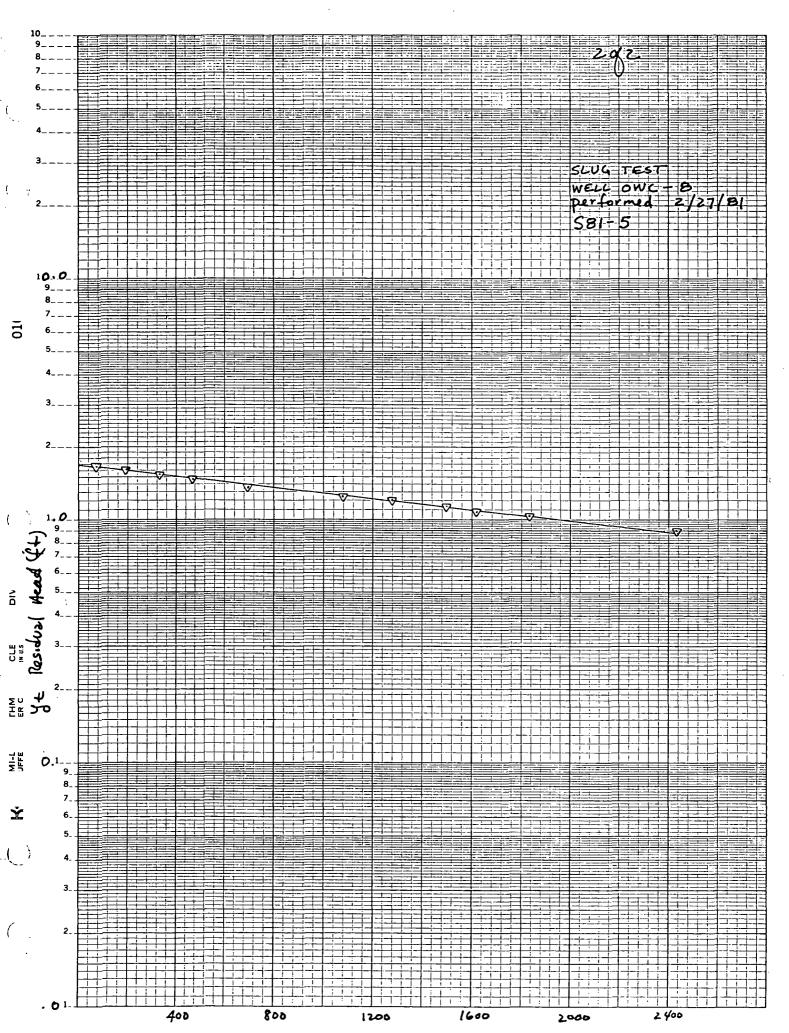
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 $f = 27$ 

SLUG TEST, UNCONFINED \_\_ DATE*5/29/81* JOB NO.



time (Seconda)

History Given Assumptions Reasoning Solution.

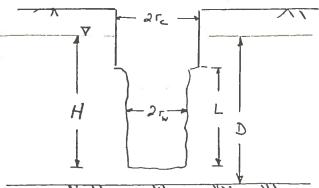
Conclusions

Well OWC-9

$$\Gamma_{L} = 0.333$$
 ft  
 $\Gamma_{C} = 0.167$  ft  
 $L = 20.0$  ft  
 $D = 41.8$  ft  
 $H = 29.8$  ft

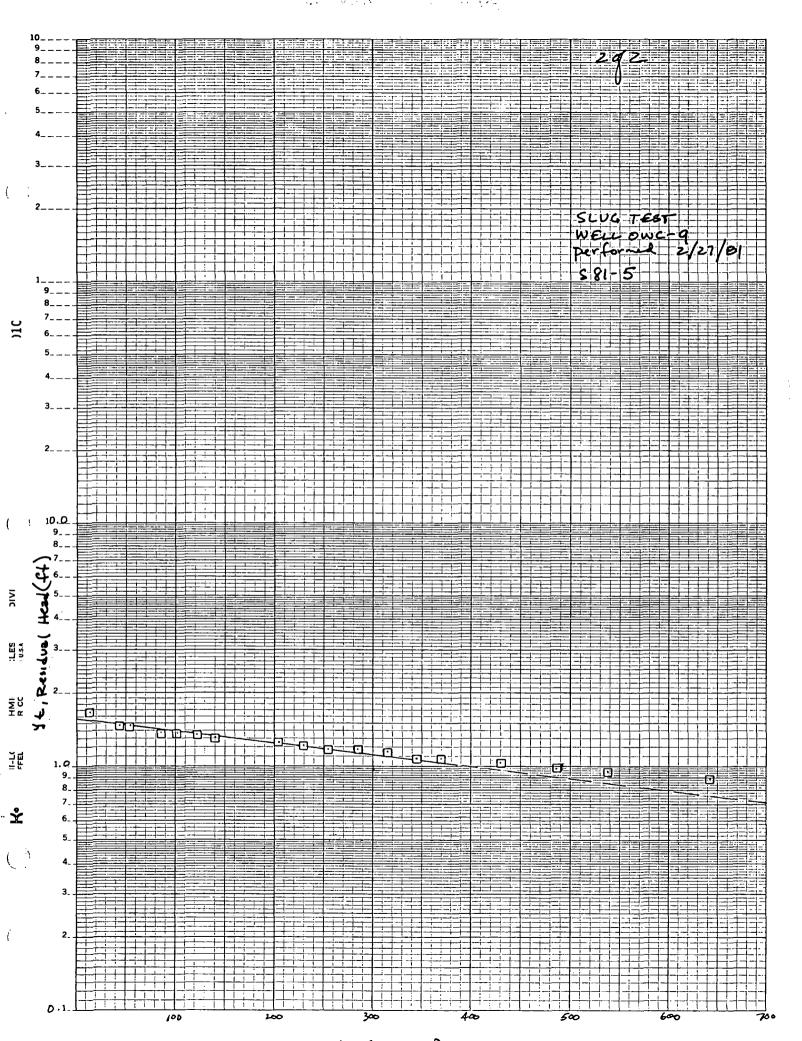
$$\frac{1}{100} = \frac{20}{.333} \frac{Fr}{fr} = 60.06$$
  $\frac{1}{100} = \frac{1}{100} \frac{1}{100} = \frac{20}{100} \frac{Fr}{fr} = \frac{20.51}{100} \frac{Fr}$ 

$$T = k \cdot D$$



JOB S81-5 CALC: SLUG TEST, UNCONFINED BY P Knotte DATE CHKD BY 148

\_\_\_\_ DATE <u>\$\frac{29/\varepsilon}{29/\varepsilon} \text{JOB NO.} .</u>



TIME (SECONDS)

Problem History Given Assumptions Reasoning Solution Conclusions

Well OWC-15

Well OWC-15

$$Conclusions$$

$$C = 0.333 \text{ ft}$$

$$C = 0.167 \text{ ft}$$

$$L = 10.0 \text{ ft}$$

$$D = 20.0 \text{ ft}$$

$$D = 12.5 \text{ ft}$$

$$S = 171 \text{ ft} (c.l.), 1.86 \text{ ft} (5 \text{cm/h.c.l.})$$

$$S = 171 \text{ ft} (c.l.), 1.86 \text{ ft} (5 \text{cm/h.c.l.})$$

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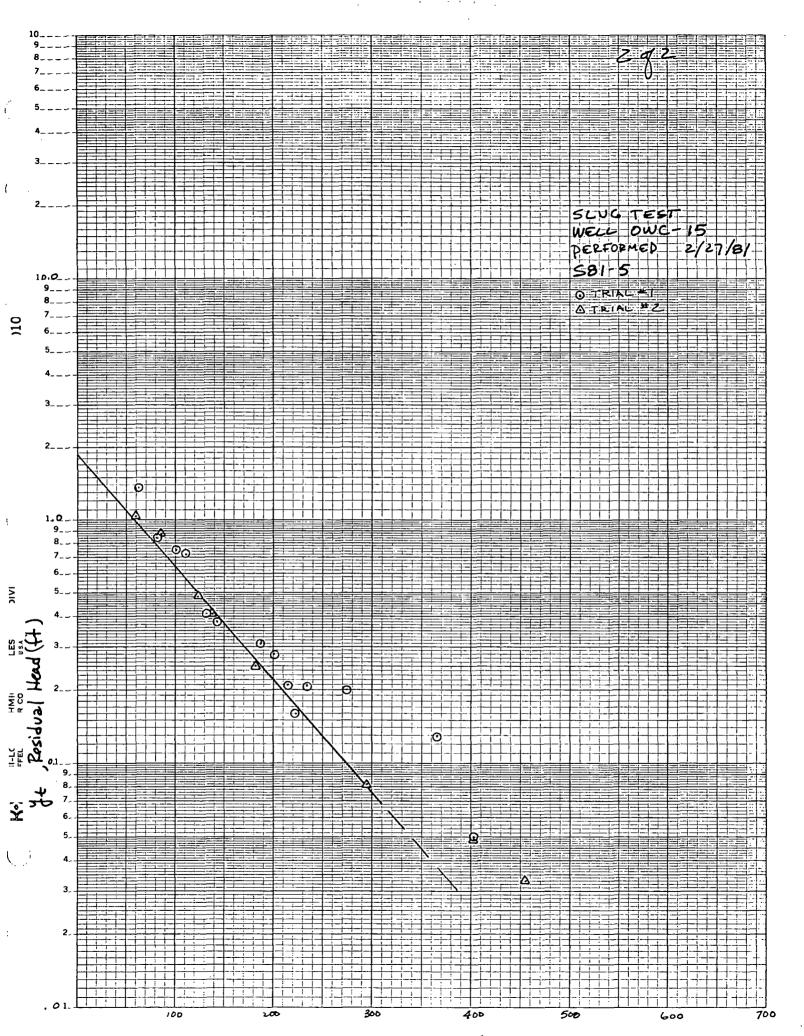
$$S = 0.38 \text{ ft}$$

$$S = 0.38 \text{ ft}$$

SLUG TEST UNCONFINED

CHKD BY 1/8

DATE 5/2 JOB 581-5\_\_\_\_ \_\_\_ DATE *5/29/E/* JOB NO.



TIME (SECONDS)

#### APPENDIX D

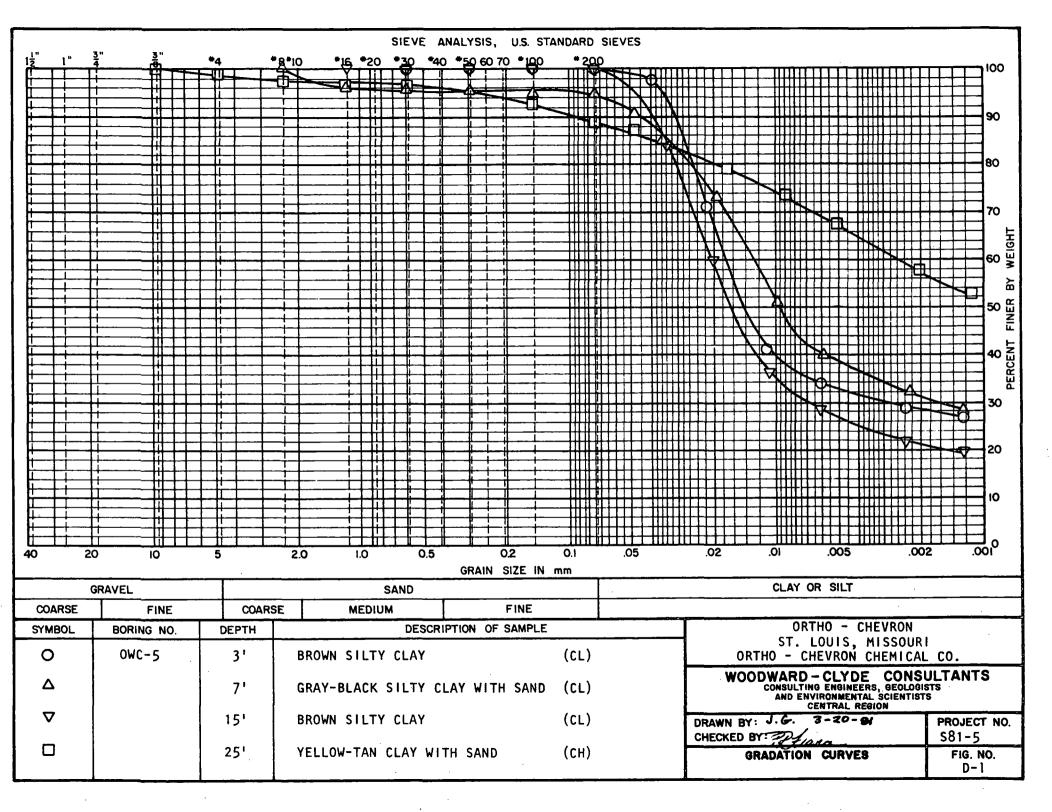
ENGINEERING INDEX SUMMARY TABLE AND GRAIN SIZE CURVES

### TABLE D-1

### SUMMARY OF LABORATORY TEST DATA

ORTHO-CHEVRON ST. LOUIS, MISSOURI S81-5

| }                          |                           |                   |                                       |                                  |                      |                 |                  |                               |                             | 301                          |                                 |                         |                          | 21112         |                                 |                               |                                    |   |                      |   |
|----------------------------|---------------------------|-------------------|---------------------------------------|----------------------------------|----------------------|-----------------|------------------|-------------------------------|-----------------------------|------------------------------|---------------------------------|-------------------------|--------------------------|---------------|---------------------------------|-------------------------------|------------------------------------|---|----------------------|---|
|                            |                           |                   |                                       |                                  | CLASSIF              | CATION          | PRO              | PERTIES                       |                             |                              | СОМ                             | PRESSIV                 | E STRE                   | PHYSI<br>NGTH | CAL PR                          | OPERTIES                      |                                    | ME CHAI                                 | NGE                  |   |
|                            | UMBER                     |                   | ).                                    |                                  |                      |                 |                  |                               |                             | UNC                          | ONFINE                          | )                       | т                        | RIAXIAL       | -                               | ı                             |                                    | 1                                       | l<br>Z               |   |
|                            | BORING OR TEST PIT NUMBER | SAMPLE DEPTH, ft. | UNIFIED SOIL<br>CLASSIFICATION SYMBOL | AVERAGE NATURAL WATER CONTENT, % | DRY UNIT WEIGHT, pcf | LIQUID LIMIT, % | PLASTIC LIMIT, % | LIMIT SAMPLE WATER CONTENT, % | GRAIN SIZE<br>DATA – FIGURE | COMPRESSIVE<br>STRENGTH, ksf | WATER CONTENT AT END OF TEST, % | STRAIN AT<br>FAILURE, % | TRIAXIAL DATA-<br>FIGURE | TYPE OF TEST  | WATER CONTENT<br>START - END, % | VOLUME CHANGE DATA<br>FIGURES | EXISTING OVERBURDEN<br>STRESS, ksf | ESTIMATED PRECONSOL IDATION STRESS, kef | VOLUME CHANGE, INUN- | SWELL PRESSURE<br>MAXIMUM - CONFINED<br>INNUNDATED, psi |
|                            | OWC-5                     | 1                 | CL                                    | 24                               |                      | 41              | 20               |                               | D-1                         |                              |                                 |                         |                          |               |                                 |                               |                                    |   |                      |   |
|                            |                           | 7                 | CL                                    | 25                               |                      | 48              | 20               |                               | D-1                         |                              |                                 |                         |                          |               |                                 |                               |                                    |   |                      |   |
|                            |                           | 15                | CL                                    | 27                               |                      | 32              | 19               |                               | D-1                         |                              |                                 |                         |                          |               |                                 |                               |                                    |   | }                    |   |
|                            |                           | 25                | сн                                    | 26                               |                      | 63              | 23               |                               | D-1                         |                              |                                 |                         |                          |               |                                 | :                             |                                    |   |                      |   |
|                            |                           |                   | 1                                     |                                  |                      |                 |                  |                               |                             |                              |                                 |                         |                          |               |                                 |                               |                                    |   |                      |   |
|                            |                           |                   |                                       |                                  |                      |                 |                  |                               | !                           | 1                            |                                 |                         |                          |               |                                 |                               |                                    |   |                      |   |
| W00                        |                           |                   |                                       |                                  |                      |                 |                  |                               |                             |                              |                                 |                         |                          |               |                                 |                               |                                    |   |                      |   |
| DWARD-                     |                           |                   | i<br>!                                |                                  |                      |                 |                  |                               |                             |                              |                                 |                         |                          |               |                                 |                               |                                    |   |                      |   |
| CLYOE                      |                           |                   |                                       |                                  |                      |                 |                  |                               |                             |                              |                                 |                         |                          |               |                                 |                               |                                    |   |                      |   |
| WOODWARD-CLYDE CONSULTANTS |                           |                   |                                       |                                  |                      |                 |                  |                               |                             |                              |                                 | ,                       |                          |               |                                 | ·                             |                                    |   |                      |   |
| STNVI                      |                           |                   |                                       |                                  |                      |                 |                  |                               |                             | _                            |                                 |                         |                          |               |                                 |                               |                                    |   |                      |   |



APPENDIX E

EPA HAZARDOUS WASTE ANALYSIS REPORT FORM

528 NORTH NINTH • SALINA, KANSAS 67401 • LAB: (913) 825-7186 OFFICE: (913) 827-0433

#### LABORATORY REPORT

Waste Generator: Chevron Ortho Division

Location of Waste Generation:

Process Producing Waste:

Description of Waste:

Quantity of Waste Produced:

Average Monthly -

Maximum Monthly -

Annual -

Wastes produced but not covered by these tests: (If any other wastes are known to be produced by the same process but are not being analyzed, they should be described).

Parameter(s) being tested: EP (Extraction Procedure) Toxicity Test for Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, Toxaphene, Lindane, Methoxychlor, 2,4-D, and 2,4,5-TP, as per "Hazardous Waste Management System", Federal Register, 45(98), May 19, 1980.

Samples were collected on Feb. 24 and 27, 1981 by Peter Barrett and Philip Knotts of Woodward-Clyde Consultants, St. Louis, Missouri

Analysis portion of EP Toxicity Test was completed on 12 March 1981, according to "Hazardous Waste Management System", Federal Register, 45(98); 33127-33128, May 19, 1980.

These wastes do not exhibit the characteristics of EP Toxicity as defined in and tested according to "Hazardous Waste Management System", Federal Register, 45(98), May 19, 1980.

File No. 81-9521
Lab No. 8103-0184E, S81-5 Dirt Pile; 8103-0213E, S81-5 B212 7 ft. 3-3,4
8103-0213E
S81-5 B212 3 ft. 1-3,4
Date: 13 March 1981

# APPENDIX F GROUNDWATER CHEMISTRY RESULTS

Observation Well: OWC - |

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

2-27-81 Date Received:

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled:

2-26-81

Time Sampled: 10:45

| ANALYSIS                                | CON      | CENTRATION          | UNITS              | A      | NALYST  | BOOKA      | / የሶ | ١GE |
|---|----------|---------------------|--------------------|--------|---------|------------|------|-----|
| LAB NUMBER: 8102-0779A                  |          |                     |                    |        | 0 (3) 3 |            |      |     |
|   | SPEUINI. | TWO I KUCI TU       | NS: NO FREE        |        |         |            |      | -   |
| DATE SAMPLED                            |          | 2/26/81             |                    |        | 12      |            | 1    | 67  |
| TIME SAMPLED                            |          | 1045                |                    |        |         |            | /    |     |
| ALKALINITY, TOTAL                       | -        |                     |                    |        | /       |            |      | -   |
| CALCIUM, BY EDTA TITRAI.                | 100      | 112                 | MG/L               |        | CJA     | 82         |      |     |
| CHLORIDE                                |          |                     |                    |        | PLP-    | 1-08       |      |     |
| FLUORIDE                                |          | 0.215               | MG/L               |        | CJA     | 25         |      |     |
| IRON, TOTAL                             |          |                     | MG/L -             |        | /-      | 5.5 55 3   |      |     |
| MAGNESIUM                               |          |                     | MG/L               |        | - '.    |            |      |     |
| MANGANESE                               |          |                     | MG/L AS N          | -      | /-      | W W        |      | -   |
| NITRATE<br>ORTHOPHOSPHATE               |          | ND(0.05) -          | MG/L AS-F          |        | BL.D    | 100        | ,    | 0   |
| PH                                      |          | 6.50                | HUYL HS-FILL       |        | LKN     | 83         |      |     |
| POTASSIUM                               |          | 0.30                | MG/L               |        | - /:    | - 65       |      | ′   |
| SILICON                                 |          |                     | MG/L               |        | 1       | _          |      |     |
| SODIUM                                  |          |                     |                    |        | / .     |            | 2.0  |     |
| SPECIFIC CONDUCTANCE                    |          | 1210                | UMHOS/CM           |        | MJB     | 124        | 1    | 1   |
| SULFATE                                 |          |                     | 116/L              |        |         |            |      |     |
| TOTAL ORGANIC CARBON                    |          | 2.6                 | MG/L               |        | GMD     | 85         | 1    | 6   |
| CONCLUSIONLAB NUMBE                     | R: 8102- |                     |                    |        |         |            |      |     |
|   |          |                     |                    |        |         |            |      | ÷   |
| LAB NUMBER: 8102-07798                  | CAMPUE   | DECCE TOTAL         | + 000-1            |        |         |            |      |     |
| LHB NUMBER: 8102-07775                  |          |                     | NS: FILTER GLASS   | FIBER  | 1 15000 | SE - F 3   | _    |     |
| GLDRIN                                  |          | 0.12                | UG/L               |        | CUE     | 132        | 7    | 2   |
| CHLORIANE                               | _        | ND(1.0)             | UGZL               |        | CJB     | 132        | 1    | 2   |
| 4 - 4 - DDL                             |          | ND(0.20)            | UGZL               |        | C.IF    | 132        | 1    | 2   |
| 4,4-DDE                                 |          | NETO.201            | HSZL               |        | CJD     | 132        | 1    | 2   |
| 4,4-I(D)                                |          | ND(O.70)            | UG/L               |        | CJE     | 132        | 1    | 2   |
| DIELDRIN                                |          | ND(0.20)            | UG/L               |        | CJE     | 132        | 1    | 2   |
| ENIRIN                                  |          | ND(0.40)            | UG/L               |        | BKS     | 132        | 1    | 2   |
| HEFTACHLOR                              |          | NE(0.10)            | UGZI.              |        | CJB     | 132        | 1    | 2   |
| MALATHION                               |          | ND(2.0)             | UG/L               |        | CJB     | 132        | 1    | 2   |
| SEVIN                                   |          | NOT ANAL.           | UCZI_              | 9      | -CJB :- | 132        | 1    | 2   |
| 2+4+5-T                                 |          | NIGG . 2.3          | RIC YL             |        | CJE     | 132        | 1    | 2   |
| TOXAPHENE                               |          | ND(10.0)            | UG/L               |        | CJB     | 132        | 1    | 2   |
| PCR                                     |          | NE(10.0) -          | -4167L ===         |        | GJE     | 132        | d.   | 2   |
| LINDANE                                 |          | -0.26               | UG/L               |        | CUB     | 132        | 1    | 2   |
| METHOXYCHLOR                            |          | NI:(0.8)            | UG/L               |        | CJB     | 132        |      |     |
| 2 , 4-D                                 |          | 1.8                 | UG/L               |        | CUB     | 132        |      |     |
| MIREX                                   |          | ND(0.5)             | UG/L               |        | CUB -   | 132        | 1    | 2   |
| CAFTAN                                  |          | ND(0.20)            | UG/L               |        | CJB     | 132        | 1    | 2   |
| DIFOLATAN                               |          | ND(20)              | 41G/L              |        | G4B     | 132        | 1    | Ş   |
| CHLOROBENZILATE                         |          | NI(0.30)            | UG/L               |        | CJB     | 132        | 1    | 2   |
| GUTHION                                 |          | NI(100)             | UG/L               |        | -CJB    |            |      |     |
| DIAZINON                                |          | NI(0.5)             | UG/L               |        | CJB     | 132        |      |     |
| PARATHION, METHYL                       |          | ND(2.0)             | UG/L               | 020402 | CUB     | 132        | 1    | 7   |
| PARATHION, ETHYL                        |          | ND(0.5)             | UG/L               |        | CJB     | 132        | 1    | 2   |
| TRITHION                                |          | NOT ANAL.           | UG/L               |        | - C##   |            |      |     |
| PHOSDRIN (MEVINPHOS)CONCLUSIONLAB NUMBE | R: 8102- | ND(2.0)<br>-0779B - | UG/L               |        | CJB     | 132        | /    | 2   |
|   |          | NE(2.0)<br>-0779E - |                    |        |         | 132        |      |     |
| LAR NUMBER: RIGG-ATTER                  |          |                     | ONS: FILTERED IN F | IELD   |         |            |      |     |
| LAB NUMBER: 8102-07790                  | SILCIN   | 9 9 9 9 1           | H 30 19 19         |        |         |            |      |     |
| LAB NUMBER: 8102-0779C ARSENIC          |          | - 0.010             | MG/L               |        | RTF     | 131        | /    |     |
|   |          |                     |                    |        | RTF     | 131<br>131 |      |     |
| ARSENIC                                 |          | - 0.010             | MG/L               |        |         | 131<br>131 | 1    | 5   |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

### TABLE F-I CHEMICAL ANALYSES

Observation Well: OWC - \_\_\_\_

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-8

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-26-81

Time Sampled: 10:45

STANDARD CHEMICAL WATER ANALYSIS.

DATE: 13 MARCH 1981

LADGRATORY FILE NO.: 81-9521 LADGRATORY NO.: 8102-0779A SAMPLE RECEIVED 27 FEBRUARY 1981

| • | CATIONS                                |            |           |         |              | LABORATORY<br>ANALYSIS |                                       |
|---|--|------------|-----------|---------|--------------|------------------------|---------------------------------------|
| • | DALCIUN                                | 0042       | MG/L      | •       |              | 112.00                 |                                       |
|   | TRON                                   | LE15       | ME/L      |         |              | 112.00                 | ·                                     |
|   | MAGNESIUM                              | 116+2      | MG/L      |         |              | 42.70                  |                                       |
|   | MANGANESE                              | KN F2      | MG/L      |         |              | . 0.00.                |                                       |
|   | FOTASSIUM                              | K +1       | NG/L      |         |              | 1.90                   |                                       |
| - | SODIUM                                 | NA+1       | MG/L -    |         |              | 45.00                  |                                       |
|   |  |            |           |         |              | . ·.                   |                                       |
|   | ANIONS                                 |            |           |         |              |                        |                                       |
|   | BICARBONATE                            | HC03-1     | MGZI      |         |              | 256.03                 |                                       |
|   | CARBONATE                              | 003 -2     | MG/L      |         |              | 0.08                   |                                       |
|   | CHLORIDE                               | C1 -1      | MG/I      |         |              | 142.00                 |                                       |
|   | FLUORIDE                               | F1-        | _MG/L     |         |              | 0.22                   | · <u></u>                             |
|   | HYDROXIDE                              | OH -1      | MG/L      |         |              | 0.00                   |                                       |
|   | NITRATE                                | NO3 -1     | MG/L      |         |              | 11.52                  | السائسين الما                         |
|   | PHOSPHATE                              | FO4 -3     | MG/L      |         |              | 0.00                   |                                       |
|   | SULFATE                                | SO4 -2     |           |         |              | 140.00                 |                                       |
|   |  | SI04-4     | MG/L      |         |              | 0.03                   |                                       |
|   | 071.704                                |            |           |         |              |                        | <u></u>                               |
|   | SILICA FORE CARN                       | ON DIOSI   | *·        | 5102    | MG/L         | 40.66                  |                                       |
| • | TOTAL FREE CARB<br>EQUILIBRIUM CAR     |            |           | CD2     | MG/L         | 287.03<br>37.09        | · <del></del>                         |
|   | TOTAL DISSOLVED                        |            |           | C02     | MG/L<br>MG/L | 788.03                 |                                       |
|   | TOTAL ALKALINIT                        |            | AS        | CACOZ   |              | 209.74                 |                                       |
| • | - CALCIUM ALKALIN                      |            |           | CACCE   | MEZL :       |                        |                                       |
|   | - MACHESIUM ALRAL<br>- MACHESIUM ALRAL |            | .as       | 00003   | MC 1         | 0.00                   | · · · · · · · · · · · · · · · · · · · |
|   | SODIUN ACCALINI                        |            | <br>      | 00003   | HOZE         | 0.00                   |                                       |
|   | TOTAL MASSINGS                         |            | 05        | 07/003  | MC /L        | 455.07                 |                                       |
|   | OM CIPE HAS THES                       |            |           | 50003   | HS./Ē        | 280.00                 | •                                     |
|   | MICHEGIUT HARRY                        |            | 75        | 20002   | M371         | 175.50                 |                                       |
|   | HOL SAME CHATE H                       |            | 26        |         | MS./L        | 245.13                 |                                       |
|   | CALCULA MOVE CAN                       |            |           |         | KD 4.        | 70.06                  |                                       |
|   | EARMIDIUM ROW D                        |            |           |         | .:5. L       | 1.72.50                |                                       |
|   | F11                                    |            |           | UNITE   |              | 4.50                   |                                       |
|   | FRUITITIUM FH                          | (505)      |           | UNITS   |              | 7, 21                  |                                       |
|   | COMPRESSION CONTRACT                   |            | F.' '     | CHARG   |              | 7.23                   |                                       |
|   | SATURATION THES                        | k i        | FIII      |         |              | 0.71                   |                                       |
|   | TO PERATURE                            | * ** ** pr | ans dida  | CHEIT   |              | 48.00                  |                                       |
|   | ាស់ពីនោះ សេចកំពុងការ សេ                | SAULASD -  | MICRON    | NOVEGIE |              | 1210.00                |                                       |
|   | PORTO STRIKETH                         |            |           |         |              | 0.0172                 | •                                     |
|   | JON WALANCO BAR                        | or orpas   | ENT) BY C | ONCENTA | ATION        | -0.92                  |                                       |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

# TABLE F-2 CHEMICAL ANALYSES

Observation Well: OWC - 3

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories Salina, Kansas

File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-26-81

Time Sampled: 11:15

|  |  | CON      | CENTRATION   | UNITS  | A                  | <br>NALYST   | BOOK   | PA                   |
|--|--|----------|--|--|--------------------|--|--|----------------------|
| LAD NUMBER:  | 8102-07806   |          |  |  | **                 | •  |  | •                    |
|  | •  | SECCIAL  | INSTRUCTION  | ONS: NO PREP   |                    |  |  |                      |
| DATE SAMPLE  | II   |          | 2/26/81  |  |                    |  |  | 1.                   |
| TIME SAMPLE  |  |          | 1115   |  |                    |  |  | 7                    |
| ALKALINITY.  | TOTAL  |          |  | MOZE, AS CACOS   |                    | . /  |  | •                    |
| CALCIUM, EY  | ' ERTA TITRAT:   | ION      | 129  | MG/L   |                    | CJA  | 82   | /                    |
| CHLURIDE   |  |          | 284  |  |                    |  |  |                      |
| FLUORIDE   |  |          | 0.135  | MG/L   |                    |  | 25   |                      |
| IRON, TOTAL  | _  |          |  | MG/L   |                    | /  |  |                      |
| MAGNESIUM  |  |          |  | MG/L   |                    | /-   |  |                      |
| MANGANESE  |  |          |  | MG/L   |                    | /  |  |                      |
| NITRATE  |  |          |  | MG/L AS N<br>MG/L AS F   |                    | /  |  | ٠.                   |
| ORTHOPHOSEL  | IATE   |          | ND(0.05)   | MG/L AS F  |                    | BLD  | 128  | /                    |
| PH   |  |          | 6.55   |  |                    | LKN  | 83   | √                    |
| POTASSIUM  |  |          |  | MG/L   |                    |  |  |                      |
| SILICON  | •  | -        | · · · · · · · · · · · · · · · · · · ·  |  |                    |  |  |                      |
| SODIUM   | NEUCTANCE  |          | 1500   | MG/L<br>UMHOS/CM   |                    | · · · · ·  |  |                      |
| SULFATE  | DNDUCTANCE   |          | 1370   | MUNICAL  |                    | unk -  | . 124  | /                    |
|  | IIC CARBON -   |          | 2.5  | MG/L<br>MG/L   |                    | GMD.   | o=   |                      |
|  |  |          |  | 110/L  |                    | OHL:   | 93   | ,                    |
|  |  |          | ے کیا دیدہ   |  | · · <del>-</del> - |  |  |                      |
|  |  |          |  |  |                    |  |  |                      |
| LAD NUMBER   | 0100 07005   | 54454 F  |  |  |                    |  |  |                      |
| CAR NUMBERS  | 8102-0780B   |          |  |  |                    |  |  |                      |
|  |  | SPEUIAL  | INSTRUCTI  | ONS: FILTER GLAS   | 5 FIBER            |  |  |                      |
| ALDRIN   |  |          | NE(0.12).  | UG/4 · ·   |                    | -CJB   | 1-32   | i                    |
| CHLORDANE  |  |          | ND(1.0)  |  |                    | CJR  | 132  |                      |
| 4,4-DDD  |  |          | ND(0.20)   | UG/L   |                    |  | 132  |                      |
| 4,4-DDE  |  |          | ND(0.20)   | UG/L .   |                    | CJB  | 132  |                      |
| 4,4-DDT  |  |          | ND(0.30)   | UG/L   |                    |  | 132  |                      |
| DIELDRIN   |  |          | ND(0.20)   | UG/L   | -                  | CJB  | 132  |                      |
| ENDRIN   |  |          | NII (0.40)   | UG/L .   |                    | BKS  | 132-   | 1                    |
| HEPTACIILOR  |  |          | ND(0.10)   | UG/L   |                    | CUB  | 132  | /                    |
| MALATHION  |  |          | NI((2+0)   | UG/L   |                    | GUR<br>GUR<br>GUR  | 132  |                      |
| SEVIN  |  |          | NOT ANAL.  |  |                    |  |  |                      |
| 2,4,5-T  | •  |          | 0.1  | UG/L   |                    | CJB  | 132  | 1                    |
| TOXAPHENE  |  |          | ND(10.0)   | UG/L   |                    | CJF  | 132  | /                    |
| 505  |  |          |  |  |                    |  |  |                      |
| PCB  |  |          | ND(10.0)   | UG/L   | ·                  | CJB  | 132<br>-132  | 1.                   |
| LINDANE  | ır.  |          | ND(10.0)<br>-1.07  | NG\F<br>NG\F   |                    | CJI  | 132  | 1                    |
| LINDANE<br>HETHOXYCHLO   | æ  |          | ND(10.0)<br>-1.07<br>ND(0.8)   | NG\r<br>NG\r<br>NG\r   |                    | CJE  | 132<br>132   | /                    |
| LINDANE<br>HETHOXYCHLO<br>2,4-D  | )R   |          | ND(10.0)<br>-1.07<br>ND(0.8)<br>ND(1.0)  | UG/L<br>UG/L<br>UG/L   |                    | CTB<br>CTB<br>CTI:   | 132<br>132<br>132  | 111                  |
| LINDANE<br>METHOXYCHLO<br>2,4-D<br>MIREX   | JR   |          | ND(10.0)<br>-1.07<br>ND(0.8)<br>ND(1.0)<br>ND(0.5)   | UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L   |                    | CTB<br>CTB<br>CTI:   | 132<br>132<br>132  | 111                  |
| LINDANE<br>HETHOXYCHLO<br>2,4-D<br>HIREX<br>CAFTAN   | Я  |          | NB(10.0)<br>-1.07<br>NB(0.8)<br>NB(1.0)<br>NB(0.5)<br>HB(0.20)   | NG\F<br>NG\F<br>NG\F<br>NG\F<br>NG\F<br>NG\F   |                    | CAB<br>CAB<br>CAB<br>CAB   | 132<br>132<br>132<br>132<br>132                                    | 11/11                |
| LINDANE HETHOXYCHLO 2,4-D HIREX CAPTAN DIFOLATAN   |  |          | ND(10.0)<br>-1.07<br>ND(0.8)<br>ND(1.0)<br>ND(0.5)<br>HD(0.20)<br>ND(20)   | UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L   |                    | CAB<br>CAB<br>CAB<br>CAB<br>CAB                                    | 132<br>132<br>132<br>132<br>132<br>132                             | 111111               |
| LINDANE HETHOXYCHLO 2,4-D HIREX CAFTAN DIFOLATAN CHLOROBENZI   |  |          | NB(10.0)<br>-1.07<br>NB(0.8)<br>NB(1.0)<br>NB(0.5)<br>HB(0.20)   | NG\F<br>NG\F<br>NG\F<br>NG\F<br>NG\F<br>NG\F   |                    | CAB<br>CAB<br>CAB<br>CAB   | 132<br>132<br>132<br>132<br>132<br>132                             | 111111               |
| LINDANE HETHOXYCHLO 2,4-D HIREX CAFTAN DIFOLATAN CHLOROBENZI GUTHION   |  |          | ND(10.0)<br>11.07<br>ND(0.8)<br>ND(1.0)<br>ND(0.5)<br>HD(0.20)<br>ND(20)<br>ND(0.30)<br>ND(100)  | UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L                                 |                    | CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB                             | 132<br>132<br>132<br>132<br>132<br>132<br>132                      | 111111111            |
| LINDANE HETHOXYCHLO 2,4-1 HIREX CAFTAN DIFOLATAN CHLOROBENZI GUTHION DIAZINON  | LATE   |          | ND(10.0)<br>-1.07<br>ND(0.8)<br>ND(1.0)<br>ND(0.5)<br>HD(0.20)<br>ND(0.30)<br>ND(0.30)<br>ND(100)  | UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L                         |                    | COB COB COB COB COB COB COB COB COB COB COB                        | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132               | 111111111            |
| LINDANE METHOXYCHLO 2,4-D HIREX CAFTAN DIFOLATAN CHLOROBENZI GUTHION DIAZINON DARATHION  | LLATE<br>METHYL  |          | ND(10.0)<br>-1.07<br>ND(0.8)<br>ND(1.0)<br>ND(0.5)<br>HD(0.20)<br>ND(20)<br>ND(0.30)<br>ND(100)<br>-1.7<br>ND(2.0)   | UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L                 |                    | COB COB COB COB COB COB COB COB COB                                | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132               | 11111111111          |
| LINDANE METHOXYCHLO 2,4-D MIREX CAPTAN DIFOLATAN CHLOROBENZI GUTHION DIAZINON PARATHION, PARATHION,  | LLATE<br>METHYL  |          | ND(10.0) -1.07 ND(0.8) ND(1.0) ND(0.5) HD(0.20) ND(20) ND(0.30) ND(100) -1.7 ND(2.0) ND(0.5)   | UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L |                    | CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB        | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | 111111111111         |
| LINDANE METHOXYCHLO 2,4-D MIREX CAPTAN DIFOLATAN CHLOROBENZI GUTHION DIAZINON PARATHION, PARATHION, PARATHION  | ILATE<br>METHYL<br>ETHYL                                 |          | NB(10.0) -1.07 NB(0.8) NB(1.0) NB(0.5) NB(0.20) NB(20) NB(20) NB(100) -1.7 NB(2.0) NB(2.0) NB(2.0) NB(2.0) NB(2.0) NB(3.0)                                   | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  |                    | CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB        | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | 111111111111         |
| LINDANE METHOXYCHLO 2,4-D MIREX CAPTAN DIFOLATAN CHLOROBENZI GUTHION DIAZINON PARATHION, PARATHION, PARATHION PHOSDRIK (P                              | LATE<br>METHYL<br>ETHYL<br>MEVINPHOS)                    |          | ND(10.0)<br>-1.07<br>ND(0.8)<br>ND(1.0)<br>ND(0.5)<br>HD(0.20)<br>ND(0.30)<br>ND(100)<br>-1.7<br>ND(2.0)<br>ND(0.5)<br>NDT ANAL.                             | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  |                    | CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB        | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132               | 111111111111         |
| LINDANE METHOXYCHLO 2,4-D MIREX CAPTAN DIFOLATAN CHLOROBENZI GUTHION DIAZINON PARATHION, PARATHION, PARATHION PHOSDRIK (P                              | ILATE<br>METHYL<br>ETHYL                                 |          | ND(10.0) -1.07 ND(0.8) ND(1.0) ND(0.5) HD(0.20) ND(20) ND(20) ND(100) -1.7 ND(2.0) ND(0.5) NDT ANAL ND(2.0) O7805  | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  |                    | CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB        | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | 111111111111         |
| LINDANE METHOXYCHLO 2,4-D MIREX CAPTAN DIFOLATAN CHLOROBENZI GUTHION DIAZINON PARATHION, PARATHION, PARATHION PHOSDRIK (P                              | LATE<br>METHYL<br>ETHYL<br>MEVINPHOS)                    |          | ND(10.0) -1.07 ND(0.8) ND(1.0) ND(0.5) HD(0.20) ND(20) ND(20) ND(100) -1.7 ND(2.0) ND(0.5) NDT ANAL ND(2.0) O7805  | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  |                    | CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB        | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | 111111111111         |
| LINDANE METHOXYCHLO 2,4-D MIREX CAPTAN DIFOLATAN CHLOROBENZI OUTHION DIAZINON PARATHION, PARATHION, PARATHION PHOSDRIN (MACCONCLUSION)                 | HETHYL<br>METHYL<br>ETHYL<br>MEVINPHOS)<br>NH-LAB NUCLES | Rt 8102- | NB(10.0)<br>-1.07<br>NB(0.8)<br>NB(1.0)<br>NB(0.5)<br>HB(6.20)<br>NB(20)<br>NB(20)<br>NB(100)<br>-1.7<br>NB(2.0)<br>NB(0.5)<br>NB(0.5)<br>NB(0.5)<br>NB(0.5) | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  |                    | CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB        | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | 111111111111         |
| LINDANE METHOXYCHLO 2,4-D MIREX CAPTAN DIFOLATAN CHLOROBENZI OUTHION DIAZINON PARATHION, PARATHION, PARATHION PHOSDRIN (MACCONCLUSION)                 | LATE<br>METHYL<br>ETHYL<br>MEVINPHOS)                    | R: 8102- | ND(10.0) -1.07 ND(0.8) ND(0.5) ND(0.5) ND(0.20) ND(20) ND(0.30) ND(100) -1.7 ND(2.0) ND(0.5) NDT ANAL ND(2.0) O7808  | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  |                    | COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | //////////////////// |
| LINDANE METHOXYCHLO 2,4-D MIREX CAFTAN DIFOLATAN CHLOROBENZI GUTHION PARATHION FARATHION FARATHION PHOSDRIN PHOSDRIN CHONCLUSIO                        | HETHYL<br>ETHYL<br>EVINPHOS)<br>NH-LAB NUCLE             | K! 8102  | ND(10.0) -1.07 ND(0.8) ND(0.5) ND(0.5) ND(0.20) ND(0.30) ND(0.30) ND(100) -1.7 ND(2.0) ND(0.5) NDT ANAL. ND(2.0) O780B DESCRIPTIO INSTRUCTI                  | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  | ( FIELD            | CTB<br>CTB<br>CTB<br>CTB<br>CTB<br>CTB<br>CTB<br>CTB<br>CTB<br>CTB | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | 111111111111         |
| LINDANE METHOXYCHLO 2,4-D MIREX CAPTAN DIFOLATAN CHLOROBENZI GUTHION DIAZINON PARATHION, PARATHION, PARATHION PHOSDRIN (PCONCLUSIO                     | HETHYL<br>ETHYL<br>EVINPHOS)<br>NH-LAB NUCLE             | K! 8102  | ND(10.0) -1.07 ND(0.8) ND(0.5) ND(0.5) ND(0.20) ND(20) ND(20) ND(20) ND(2.0) ND(2.0) ND(2.0) ND(2.0) ND(2.0) NDT ANAL. ND(2.0) O780B                         | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  | ( FIELD            | COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | 11111111111          |
| LINDANE METHOXYCHLO 2,4-D MITEX CAFTAN DIFOLATAN CHLOROBENZI GUTHION PARATHION, FARATHION, FARATHION, TRITHION CHLOROBENZI LAB NUMBER: ARSENIC CADMIUM | HETHYL<br>ETHYL<br>EVINPHOS)<br>NH-LAB NUCLE             | K! 8102  | NB(10.0) -1.07 NB(0.8) NB(1.0) NB(0.5) NB(0.20) NB(0.30) NB(0.30) NB(100) -1.7 NB(0.5) NBT ANAL. NB(2.0) O7E0B   | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  | ( FIELD            | CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB<br>CUB | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | 111111111111         |
| LINDANE METHOXYCHLO 2,4-D MIREX CAPTAN DIFOLATAN CHLOROBENZI GUTHION DIAZINON PARATHION, PARATHION, PARATHION PHOSDRIN (PCONCLUSIO                     | HETHYL<br>ETHYL<br>EVINPHOS)<br>NH-LAB NUCLE             | K! 8102  | ND(10.0) -1.07 ND(0.8) ND(0.5) ND(0.5) ND(0.20) ND(20) ND(20) ND(20) ND(2.0) ND(2.0) ND(2.0) ND(2.0) ND(2.0) NDT ANAL. ND(2.0) O780B                         | UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L  | ( FIELD            | COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR<br>COR | 132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132<br>132 | 111111111111         |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

# TABLE F-2 CHEMICAL ANALYSES

Observation Well: OWC - 3

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-26-81

Time Sampled: | | 1:15

STANDARD CHENTCAL WATER ANALYSIS

DATE: 13 MARCH 1981

LABORATORY FILE NO.: 81-9521 LABORATORY NO.: 8102-0780A SAMPLE RECEIVED 27 FEBRUARY 1981

|  | MATERIAL MANAGEMENT |                    |              |                 |            | LABORATORY.   | #3 <b></b> |
|--|---------------------|--------------------|--------------|-----------------|------------|---------------|------------|
|  | CATIONS             |                    |              |                 |            | ANALYSIS      |            |
|  | CALCIUM             | CA+2               | MG/L         |                 |            | 122.00        | 1-1-0-     |
|  | 1RON                | FE12               | MG/L         |                 |            | - 0.05        | 2012       |
|  | MAGNESIUM .         | i16+2              | MGZL         |                 |            | 38.00         |            |
|  | MARGARESE           | h.4+2              | MG/L         |                 |            | 0.24          | M          |
|  | POTASSIUM           | N +1               | MG/L         |                 |            | 0.90          |            |
|  | SOLIUM              | NA+1               | MG/L         |                 |            | 90.00         | St. 3      |
|  |                     | _                  |              |                 | 1 124      |               |            |
|  | ANIONS              |                    |              |                 |            |               |            |
| 0.00   | TITOADDONATE        | 11007 4            |              |                 |            |               | 2.25       |
|  | BICARBONATE         | HC03-1             | MG/L         |                 |            | 158.45        |            |
|  | CARBONATE           | 003 -2             | MG/L         | -33             |            | 0.06          | 1 1        |
|  | CHLORIDE            | CL :::1<br>-F=: -1 | MG/L         |                 |            | 284.00        |            |
|  |                     | -                  | MG/L         | -               |            | 0.14          |            |
|  | HYDROXIDE           | OH -1              | MG/L         |                 |            | 0.00          |            |
|  | NITRATE             | NO3 -1             | MG/L         |                 |            | 7.97          | 78.80      |
|  | PHOSPHATE           |                    | MG/L         |                 |            | 0.00          |            |
|  | SULFATE             | S04 -2             | MG/L         |                 |            | 115.00        |            |
| CONTRACTOR OF THE CONTRACTOR O | SILICATE            | SID4-4             | MG/L         |                 |            | 0.03          |            |
|  | SILICA              | 50 R 50 S          |              | S102            | MG/L       | 34.24         |            |
|  | TOTAL FREE CARBI    | וואטות אכ          | DE           | C02             | MG/L       | 160.73        |            |
|  | EQUILIBRIUM CAR     |                    |              | 002             | MG/L       | 16.06         |            |
|  | TOTAL DISSOLVED     |                    | (CALC)       | 002             | MG/L       | 855.48        |            |
|  | TOTAL ALKALINIT     |                    | AS           | CACO3           | MSZL       | 129.94        |            |
|  | CALCIUM ALKALIN     |                    | 45           | 0AC03           | NGAL       | 127.94        |            |
|  | MAGNESIUM ALKAL     |                    | AS           | 04003           | MOZL       | 0.00          |            |
|  | SOUTUM ALKALINI     |                    | AS           | 04003           | HG/L       | 0.00          |            |
|  | TOTAL HARDNESS      | • •                | AS           | CACOS           | MG/L       | 478.15        |            |
|  | CHLCIUM HARDNES     | 3                  | AS           | CACOS           | MGZL       | 322.50        |            |
|  | LAGRESIUM HARDN     | _                  | AS           | CACOS           | MG/L       | 156.18        |            |
|  | ROR CARBONATE L     |                    | AS           | CACOS           | MOZE :     | 348.21        |            |
|  | LALCIDI HIN DAK     |                    |              | UNCOO           | MG/L       | 192.56        |            |
|  | HAGNESIUM NON-CA    |                    |              |                 | NGZL       | 156.18        |            |
|  | I rl                | 1114-5014711145    | PH           | UPITS           | 1167       | 6.55          |            |
|  | EQUILIBRIUM PH      | COMOS              | FH           | UNITS           |            | 7.37          |            |
|  | STALLLITY INDEX     |                    |              | UNITS           |            | 3.18          |            |
|  | SATURATION INDEX    |                    |              | UNITS           |            | -0.82         |            |
| (356)  | TEMPERATURE         | Luki               |              | ENGEIT          |            | 0.82<br>63.00 |            |
|  | COMBUSTIVITY, M     |                    | MISRO.       |                 |            | 1570.00       |            |
|  | IGHIC STRENGTH      |                    | *******      |                 |            | 0.0193        |            |
|  | TOR DALANCE ERRO    |                    | -<br>        |                 | A T T TAI  | 1.39          |            |
|  | JOH PHENNEL LINE    | 211 11 12/104      | -1417 101 10 | Construction PC | PER A SHIT | 1 + 37        |            |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45 $\mu$  membrane) and acid preserved in the field.

#### TABLE F-3 CHEMICAL ANALYSES

Observation Well: OWC - 4

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received:

2-26-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-8|

Time Sampled: 16:00

| ANALYSIS   | CONCENTRATION  | UNITS   | ANAL YST  | BOOKZPA   |
|--|--|---|---|---|
| LAB NUMBER: 8102-0699A   | CAMBLE DECEMBERS   | I DUC A CUCUDON   |   |   |
| CAN MOUNTH. GIOZ 9577A   | SPECIAL INSTRUCTION  |   |   |   |
| DATE SAMPLED   | 2/24/81  |   |   | /   |
| TIME SAMPLED   | 16:00  |   | \$ \$44   | = /   |
| ALDRIN   | ND(0.12)   | UG/L  | CJB   | 132 /   |
| CHLORDANE  | ND(1.0)  | UG/L ·  | ⊗ B = CAB ≥   |   |
| 4,4-DDD  | ND(0.20)   | UG/L  | CJB   | 132 /   |
| 4,4-DDE  | ND(0.20) -   |   | - CJB   |   |
| 4,4-DDT<br>DIELDRIN  | ND(0.30)   | UG/L  | CJB   | 132 /   |
| ENDRIN   | ND(0.20)   | UG/L  | · CJB   | 132./   |
| HEPTACHLOR   | ND(0.40)   | UG/L<br>UG/I  | BKS   | 132 /   |
| MALATHION  | ND(2.0)  | UG/L  | CTR   | 132 /-<br>132 /   |
| SEVIN  | NOT ANAL.  |   |   |   |
| 2,4,5-T  | -1.9   | UG/L  | CJB   | 132 /   |
| TOXAPHENE  | ND(10.0)   | UG/L  | CJB   | 132 /   |
| PCB  | NI(10.0)   | UG/L  | CJB   | 132 /   |
| LINDANE  | -1.25  | UG/L  |   | 132 /   |
| METHOXYCHLOR   | (B.0) UN   | UG/L  | CJB   | 132 /   |
| 2.4-D  |  | JIG/L =   | CJB -   | 132 -/-   |
| MIREX  | ~ 3.07   | UG/L  | CJB   | 132 /   |
| CAPTAN   | ND(0.20)   | UGZL  | - CJB   | 132 ✓   |
| DIFOLATAN  | ND(20)   | UG/L  | CTB   | 132 /   |
| CHLOROBENZILATE  | NECO+30)   | UG/L  | CJB   | 132 /   |
| GUTHION<br>DIAZINON  | ND(100)  | UG/L  | CJB   | 132 /   |
| PARATHION, METHYL  | 1.6<br>NI(2.0)   | UG/L<br>UG/L  | CUB -   |   |
| PARATHION, ETHYL   | ND(0.5)  | UG/L  | CIB   | 132 /<br>132 /  |
| TRITHION   | NOT ANAL.  | UG/L  |   | 132 /   |
| PHOSPRIN (MEVINEROS)   | ND(2+0)  |   |   |   |
| - CONCLUSIONLAE NUMBE  |  | UG/L  | COB   | 132 /   |
| - CONCLUSIONLAR NUMBE  | MI 8102-0699A  | UG/L =  |   | 132 /   |
|  | M: 8102-0699A  | =<br>N: DWC-4 CHEVRON   | des de continuis es   | 132 /   |
|  | M: 8102-0699A  | =<br>N: DWC-4 CHEVRON   |   | 132 /   |
| LAB NUMBER: 8102-0/09B   | SAMPLE DESCRIPTION SPECIAL INSTRUCTION NO(0.001)   | N: OWC-4 CHEVRON<br>ONS: FILTERED IN<br>MG/L-   | FIELD   | 131-/   |
| LAB NUMBER: 8102-0/998 ARSENIC CADMIUM   | SAMPLE DESCRIPTION SPECIAL INSTRUCTION NB(0.001) 0.0021  | N: OWC-4 CHEVRON<br>ONS: FILTERED IN<br>MG/L —<br>MG/L  | FIELD<br>HTF—<br>RCR  | 131 /   |
| LAB NUMBER: 8102-0/09B   | SAMPLE DESCRIPTION SPECIAL INSTRUCTION NE(0.001) 0.0021 0.0023   | N: OWC-4 CHEVRON<br>ONS: FILTERED IN<br>MG/L-   | FIELD<br>HIF—<br>RCR<br>RGR   | 131 /<br>130 /<br>- 130 /   |
| LAB NUMBER: 8102-0/09B  ARSENIC CADMIUM COPPER   | SAMPLE DESCRIPTION SPECIAL INSTRUCTION NO(0.001) 0.0021 0.0023 0.048   | N: OWC-4 CHEVRON<br>ONS: FILTERED IN<br>MG/L<br>MG/L<br>MG/L  | FIELD<br>HTF—<br>RCR  | 131 /<br>130 /<br>- 130 /   |
| LAB NUMBER: 8102-0/29B  ARSENIC CADMIUM COPPER ZINCCONCLUSION -LAB NUMBER  | ### 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION NO(0.001) 0.0021 0.0023 0.048 R: 8102-04998   | N: OWC-4 CHEVRON<br>ONS: FILTERED IN<br>MG/L —<br>MG/L<br>MG/L<br>MG/L  | FIELD<br>HIF—<br>RCR<br>RGR   | 131 /<br>130 /<br>- 130 /   |
| LAB NUMBER: 8102-0/09B  ARSENIC CADMIUM COPPER ZINC  | ### 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION NO(0.001) 0.0021 0.0023 0.048 R: 8102-04998   | N: DWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L MG/L MG/L N: DWC-4 CHEVRON  | FIELD<br>HIF—<br>RCR<br>RGR   | 131 /<br>130 /<br>- 130 /   |
| LAB NUMBER: 8102-0/29B  ARSENIC CADMIUM COPPER ZINCCONCLUSION -LAB NUMBER  | SAMPLE DESCRIPTION SPECIAL INSTRUCTION NO.0021 0.0023 0.048 R: 8102-04998 SAMPLE DESCRIPTION   | N: DWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L MG/L MG/L N: DWC-4 CHEVRON  | FIELD<br>HIF—<br>RCR<br>RCR   | 131 /<br>130 /<br>130 /<br>130 /  |
| LAB NUMBER: 8102-0/09B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER  LAB NUMBER: 8102-0699C  | SAMPLE DESCRIPTION SPECIAL INSTRUCTION NO.0021 0.0023 0.048 R: 8102-04998 SAMPLE DESCRIPTION SPECIAL INSTRUCTION SPECIAL INSTRUCTION   | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L N: OWC-4 CHEVRON ONS: NO PREP   | FIELD  HIF-  RCR  RCR  RCR  | 131 /<br>130 /<br>130 /<br>130 /  |
| LAB NUMBER: 8102-0/99B  ARSENIC CADMIUM COPPER ZINCCONCLUSION -LAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL   | SAMPLE DESCRIPTION SPECIAL INSTRUCTION NO.0021 0.0023 0.048 R: 8102-04998 SAMPLE DESCRIPTION SPECIAL INSTRUCTION SPECIAL INSTRUCTION   | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L N: OWC-4 CHEVRON ONS: NO FREP MG/L, AS CACO3 MG/L MG/L  | FIELD  BIF—  RCR RCR RCR  | 131 /<br>130 /<br>130 /<br>130 /  |
| LAB NUMBER: 8102-0/99B  ARSENIC CADMIUM COPPER ZINCCONCLUSION -LAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDITA TITRAT CHUGRIDE FLUORIDE  | SAMPLE DESCRIPTION SPECIAL INSTRUCTION 0.0021 0.0023 0.048 R: 8102-06998  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 110 100 101 100 100 101 101 101 101 10  | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD RCR RCR RCR RCR   | 131 /<br>130 /<br>130 /<br>130 /<br>47 /<br>82 /  |
| LAB NUMBER: 8102-0/29B  ARSENIC CADMIUM COPPER ZINCCONCLUSION -LAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRAT CHLORIDE IRON, TOTAL  | SAMPLE DESCRIPTION SPECIAL INSTRUCTION NO (0.001) 0.0021 0.0023 0.048 R: 8102-04998  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 110 100 183 540 0.11 0.17  | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L N: OWC-4 CHEVRON ONS: NO FREP MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L   | FIELD  RCR RCR RCR RCR RCR RCR  | 131 /<br>130 /<br>130 /<br>130 /<br>130 /   |
| LAB NUMBER: 8102-0/798  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRAT CHLORIDE FLUORIDE FLUORIDE IRON, TOTAL MAGNESTUM  | SAMPLE DESCRIPTION SPECIAL INSTRUCTION 0.0021 0.0023 0.048 R: 8102-04998  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 100 101 100 103 540 0.11 0.17 44  | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L MG/L  N: OWC-4 CHEVRON ONS: NO FREP MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD  RCR RCR RCR CJA BLD CJA BLD CJA RCR RCR  | 131 /<br>130 /<br>130 /<br>130 /<br>130 /<br>47 /<br>82 /<br>108 /<br>-25 /<br>130 /  |
| LAB NUMBER: 8102-0/09B  ARSENIC CADMIUM COPPER ZINCCONCLUSION:-LAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY ENTA TITRAT CHLORINE FLUORINE FLUORINE FLUORINE MAGNESTUM MANGANESE   | #: 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 0.0021 0.0023 0.048 R: 8102-0699B  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 100 100 101 101 101 101 101 101 103 104 104 104 104 104 105 11 | N: OWC-4 CHEVRON OMS: FILTERED IN MG/L MG/L MG/L MG/L  N: OWC-4 CHEVRON OMS: NO PREP MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD  RCR RCR RCR RCR RCR RCR RCR  | 131 /<br>130 /<br>130 /<br>130 /<br>130 /<br>47 /<br>82 /<br>108 /<br>-25 /<br>130 /<br>130 /   |
| LAB NUMBER: 8102-0/99B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRAT CHLORIDE FLUORIDE IRON, TOTAL MAGGNESTUM MANGANESE NITRATE  | #: 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION  0.0021 0.0023 0.048  R: 8102-06998  SAMPLE DESCRIPTION SPECIAL INSTRUCTION  110 101 101 101 101 101 101 101 101 1                       | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L N: OWC-4 CHEVRON ONS: NO FREP MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD  RCR RCR RCR RCR RCR RCR RCJA RCR RCR RCR RCR RCR RCR RCR                       | 131 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /   |
| LAB NUMBER: 8102-0/79B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRAT CHLORIDE IRON, TOTAL MAGNESTUM MANGANESE NITRATE ORTHOPHOSPHATE   | #: 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 0.0021 0.0023 0.048 R: 8102-06998  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 100 100 100 101 100 103 540 0.11 0.17 44 0.31 2.8 0.05         | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD  RCR RCR RCR RCR RCR RCR RCR RCR RCR R  | 131 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>128 /  |
| LAB NUMBER: 8102-0/09B  ARSENIC CADMIUM COPPER ZINCCONCLUSION:-LAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDITA TITRAT CHLORIDE FLUORIDE IRON, TOTAL MAGNESTUM MANGANESE NITRATE ORTHOPHOSPHATE PH  | #: 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 0.0021 0.0023 0.048 R: 8102-0699B  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 100 100 101 100 101 101 101 101 101 10                         | N: OWC-4 CHEVRON OMS: FILTERED IN MG/L MG/L MG/L N: OWC-4 CHEVRON OMS: NO FREP MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD  RCR RCR RCR RCR RCR RCR RLD  | 131 / 130 / 130 / 130 / 130 / 130 / 130 / 130 / 130 / 128 / - 25 / 130 / 130 / 128 / - 25 / 130 / 130 / 128 / 128 / - 25 |
| LAB NUMBER: 8102-0/99B  ARSENIC CADMIUM COPPER ZINCCONCLUSION -LAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRAT CHLORIDE FLUORIDE FLUORIDE FLUORIDE IRON, TOTAL MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM                               | #: 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION  0.0021 0.0023 0.048 R: 8102-06998  SAMPLE DESCRIPTION SPECIAL INSTRUCTION  110 10N 183 540 0.11 0.17 44 0.31 2.8 0.05 5.90 2.5          | N: OWC-4 CHEVRON OMS: FILTERED IN  MG/L   | FIELD  RCR RCR RCR RCR RCR RCR BLD CJA BLD CJA RCR RCR RCR RCR RCR RCR RCR RCR RCR RC | 131 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>108 /<br>130 /<br>130 /<br>130 /<br>128 /<br>130 /  |
| LAB NUMBER: 8102-0/99B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDITA TITRAT CHLORIDE IRON, TOTAL MAGGNESTUM MANGANESE NITRATE ORTHOPHOSPHATE PH FOTASSIUM SILICON  | ### 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION  0.0021 0.0023 0.048  R: 8102-06998  SAMPLE DESCRIPTION SPECIAL INSTRUCTION  110 101 101 101 101 101 101 101 101 1                      | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L N: OWC-4 CHEVRON ONS: NO FREP MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD  RCR RCR RCR RCR RCR RCR RCR RCR RCR R  | 131 / 130 / |
| LAB NUMBER: 8102-0/79B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRAT CHLORIDE IRON, TOTAL MAGNESTUM MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM SULICON SUDDIUM                                  | ## 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 0.0021 0.0023 0.048 R: 8102-06998  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 100 100 101 110 101 101 101 101 101 10                         | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD  RCR RCR RCR RCR RCR RCR RLD CJA BLD CJA RCR RCR RCR RCR RCR RCR RCR RCR RCR RC | 131 / 130 / |
| LAB NUMBER: 8102-0/09B  ARSENIC CADMIUM COPPER ZINCCONCLUSION:-LAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDITA TITRAT CHLORIDE FLUORIDE FLUORIDE IRON, TOTAL MAGNESTUM MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM SUBIUM SPECIFIC CONDUCTANCE | #: 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 0.0021 0.0023 0.048 R: 8102-0699B  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 10N 183 540 0.11 0.17 44 0.31 2.8 0.05 5.90 2.5 14 170 2480    | N: OWC-4 CHEVRON OMS: FILTERED IN  MG/L | FIELD  RCR RCR RCR RCR RCR RCR RLD  | 131 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /<br>130 /   |
| LAB NUMBER: 8102-0/79B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER  LAB NUMBER: 8102-0699C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRAT CHLORIDE IRON, TOTAL MAGNESTUM MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM SULICON SUDDIUM                                  | ## 8102-0699A  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 0.0021 0.0023 0.048 R: 8102-06998  SAMPLE DESCRIPTION SPECIAL INSTRUCTION 100 100 101 110 101 101 101 101 101 10                         | N: OWC-4 CHEVRON ONS: FILTERED IN MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD  RCR RCR RCR RCR RCR RCR RCR RCR RCR R  | 131 / 130 / |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45 $\mu$  membrane) and acid preserved in the field.

# TABLE F-3 CHEMICAL ANALYSES

Observation Well: OWC - 4

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas

File No. 81-9521

Date Received: 2-26-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: \_\_\_\_\_ | 16:00

STANDARD CHEMICAL WATER ANALYSIS

\_\_ DATE: 13 MARCH 1981

| -LABORATORY FILE NO.<br>LABORATORY NO.: 81<br>SAMPLE RECEIVED 26 | 02-06990                     |                            |                                       |
|--|------------------------------|----------------------------|---------------------------------------|
| CATIONS  |                              | * ANALYSIS                 | Y                                     |
| CALCIUM CATIRON - FET MAGNESIUM MGT MANGANESE MNT                | 2 -MG/L                      | 183.00<br>                 |                                       |
| FOTASSIUM K +<br>SODIUM NA+                                      | 1 MG/L<br>1 MG/L             | 2.50<br>170.00             |                                       |
| ANIONS   |                              |                            |                                       |
| BICARBONATE HCC  | 3-1 MG/L                     | 134.19                     |                                       |
|  |                              | 0.01=                      |                                       |
|  | -1 MG/L<br>-1 MG/L           | 540.00<br>0.11             |                                       |
|  | -1 MG/L                      | 0.00                       | × × × × × × × × × × × × × × × × × × × |
|  | -1 MG/L                      |                            |                                       |
| PHOSPHATE FO4  | -3 MG/L                      | 0,15                       |                                       |
|  | -2 MG/L                      |                            | 2                                     |
| SILICATE SIO   | 14-4 MG/L                    | 0.01                       |                                       |
| SILICA   | \$102                        | MG/L 29.96                 |                                       |
| TOTAL FREE CARBON D  |                              |                            |                                       |
| EQUILIBRIUM CARBON   | DIOXIDE CO2<br>.IDS (CALC) - |                            |                                       |
| TOTAL ALKALINITY   | AS CACO3                     |                            |                                       |
| CALCIUM ALKALINITY   |                              | -MG/4- 109+93              |                                       |
| MAGNESIUM ALKALINIT  | Y AS CACO3                   | MG/L 0.00                  |                                       |
| SODIUM ALKALINITY  | AS CACO3                     | MG/L 0.00                  |                                       |
| TOTAL HARDNESS   | AS CACO3                     | MG/L 637.56                |                                       |
| CALCIUM HARDNESS<br>HAGNESIUM HARDNESS                           | AS CACO3<br>AS CACO3         | MG/L 457.50<br>MG/L 180.84 |                                       |
| NAME DARRONATE HARLS   | IESS - AS - CACGE            | MG/L 527+63                | ray of a second                       |
| CALCIUM NON-CASSORA  |                              | MG/L 347.57                |                                       |
| MAGNESIUM NON-CARDO  | MATE MARBNESS                | MG/L 100.84                |                                       |
| PH   | FH UNITS                     | 5.90                       |                                       |
| EQUILIBRIUM PH (FHS  |                              | 7+28                       |                                       |
| STABILITY INDEX  |                              | 8.66                       |                                       |
| SATURATION INDEX TEMPERATURE                                     | DEGREES CAMBENHEIT           |                            |                                       |
|  | HIED HICROHANGSZOM           |                            |                                       |
| IONIC STRENGTH (MEL  |                              | 0.0249                     | - 0.50 Aug. 1                         |
|  | MERCENT) BY CONCLAST         |                            | E E                                   |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

### TABLE **F-4**CHEMICAL ANALYSES

Observation Well: OWC - 5

Ortho Chevron Chemical Company Plant

Analyzed by Wilson Laboratories Salina, Kansas

File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-25-81

Time Sampled: 14:00

| ANALYSIS                      | CONCENTRATION           | •                              | ANALYST           |                   |        |
|-------------------------------|-------------------------|--------------------------------|-------------------|-------------------|--------|
| AB NUMBER: 8102-07614         |                         |                                |                   |                   | -      |
| ,                             | SPECIAL INSTRUCTIO      | INST NU FREF                   |                   |                   |        |
| DATE SAMPLED                  | 2/25/81                 |                                |                   | -                 | /      |
| TIME SAMPLED                  | 1400 -                  | OFFICE STATE                   |                   |                   | /      |
| ALKALINITY, TOTAL             |                         | MG/L+ AS CACO3                 | /                 |                   |        |
| CALCIUM, BY EDTA TITRATI      |                         | MG/L                           | CJA -             |                   | / 32   |
| THLORIDE                      | 46                      | MG/L                           | BLD               | 108 /             |        |
| FLUORIDE                      | 0.135                   | MG/L                           | CJA               | 20 /              | 7 94   |
| IRON, TOTAL                   |                         | MG/L                           | /                 | #_                |        |
| MAGNISIUM<br>MANGANESE        | -1                      | -MG/L ≈= = ==                  | /                 |                   |        |
| NITRATE                       | NI:(0.1)                | MG/L AS N                      | CJA'-             | 109               | / 32   |
| ORTHOPHOSPHATE                | 0.30                    | MG/L AS P                      | BLD               | 128               |        |
| TH                            | 6.40                    | HOZE HO I                      | LKN -             | 63                |        |
| POTASSIUM                     | 0.40                    | MG/L                           |                   |                   |        |
| SILICON                       | 2 1                     | HG/L ··                        |                   |                   | -      |
| DODIUM                        |                         | MG/L                           | /                 |                   |        |
| SPECIFIC CONDUCTANCE          | 1450                    | UMHOSZCK                       | MJB               | 124               | / 13   |
| SULFATE                       |                         | 116/L =                        | - 12              |                   |        |
| TOTAL ORGANIC CARBON          | 9.5                     | MG/L                           | GHD               | 85                | 1 69   |
| CONCLUSIONLAB NUMBER          | : 0102-0781A            |                                | +                 |                   |        |
|                               |                         |                                |                   |                   |        |
|                               |                         |                                | 10.4.11           | # 4               |        |
| LAB NUMBER: 8102-0781B        | SAROLE DESCRIPTION      | 41 UNU-2                       |                   |                   | 2.12.1 |
| min indiamity and a very      |                         | DNS: FILTER GLASS F            |                   |                   |        |
|                               |                         |                                |                   | 1 1               |        |
| DATE SAMPLED                  | 2/25/81                 |                                |                   |                   | /      |
| TIME SAMPLED                  | 1400                    | 110.41                         | (in               |                   |        |
| ALDRIN                        | ND(0.12)                | UG/L                           | CJB               | 132               |        |
| CHLORDANE<br>4,4-DDD          | ND(1.0) =<br>ND(0.20)   | UG/L                           | CJB — CJB         | 132               |        |
| 4.4-DDE                       | ND(0.20)                | UG/L                           | CJB               | 132               |        |
| 4,4-DIT                       | ND(0.30)                | UG/L                           | CJB               | 132               |        |
| DIELDRIN                      | NI((0.20)               | UG/L                           | - CJB             | 132               | 1.2    |
| ENDRIN                        | ND(0:40)                | UG/L                           | BKS               | 132               |        |
| HEPTACHLOR                    | ND(0.10)                | -UG/L                          | · CJB             | 132-              | 4.2    |
| MALATHION                     | ND(2.0)                 | UG/L                           | /                 |                   |        |
| SEVIN                         | NOT ANAL.               | UG/L                           | CUB               | 132               |        |
| 2+4+5-T                       | NI(0.1)                 | UG/L                           | CTB               | 132               |        |
| TOXAPHENE<br>PCB              | ND(10.0)                | UG/L                           | CJB               | 132               |        |
| LINDANE                       | NE(10.0)<br>0.29        | UG/L                           | CAB               | 132               |        |
| METHOXYCHLOR                  | NI(0.8)                 | UG/L<br>UG/L                   | C TB              | - 132-<br>132     |        |
| 2:4-0                         | NI((1.0)                | U6/L                           | CUR               | 132               |        |
| MIREX                         | ND(6.5)                 | UG/L                           | CJB               | 132               |        |
| CAPTON                        | ND(0.20)                | UG/L                           | CJB               | 132               |        |
| DIFOLATAR                     | NB(20)                  | UG/L                           | CJB               | 132               |        |
| CHLOROBENZILATE               | NTH(5.30)               | Men.                           | EJD               |                   |        |
| ROTHIUS                       | ND(100)                 | NC\r                           | CJB               | 132               |        |
| DIAZINON                      | ND(0.5)                 | UG/L                           | CJB               | 132               |        |
| CARATHION, METHYL             | 3.8                     | UG/L                           | CAB               | 132               |        |
| PARATHION, ETHYL              | NI(0.5)                 | UG/L                           | CJR               | 132               |        |
| TRITHION CHOSDRIN (MEVINEHOS) | NOT ANAL.<br>ND(2.0)    | UG/L<br>UG/L                   | CJB - :           | 132               | . –    |
| CONCLUSION FUR HOWFEL         |                         | UQ/ L                          |                   | 1.72              | 7 2    |
|                               |                         |                                |                   |                   |        |
| LAB NUMBER: 8102-0781C        |                         | N: OWC-5<br>ONS: FILTERED IN-F | IFLD              |                   |        |
|                               |                         |                                |                   |                   |        |
|                               | 0.003                   | HG/L                           | RTF -             |                   |        |
| ARSENIC                       |                         |                                |                   |                   |        |
| CADMIUM                       | 0.0010                  | MG/L                           | BTF               | 131               |        |
|                               | 0.0010<br>0.012<br>0.07 | MG/L<br>MG/L<br>MG/L           | BTF<br>BTF<br>BTF | 131<br>131<br>131 | / 5    |

<sup>\*</sup> Groundwater samples for metals analysis were filtered  $(0.45 \mu \text{ membrane})$  and acid preserved in the field.

TABLE F-4
CHEMICAL ANALYSES

Observation Well: OWC - 5

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-25-81

Time Sampled: 14:00

STANDARD CHEMICAL WATER ANALYSIS

DATE: 13 MARCH 1781 0

LABORATORY FILE NO.: 81 9521-LABORATORY NO.: 8102-0781A ---SAMPLE RECEIVED 27 FEBRUARY 1981

|                                       | CATIONS   |                              |                              | 100 324                 |                      | LABORATORY<br>ANALYSIS            | ra stora tora |
|---------------------------------------|---|------------------------------|------------------------------|-------------------------|----------------------|-----------------------------------|---------------|
| 5.5E 5.8                              | CALCIUM<br>IRON<br>MAGNESIUM<br>MANGANISE             | CA12<br>FE12<br>HG12<br>HN12 | MG/L<br>MG/L<br>MG/L<br>MG/L |                         | Ti.                  | 134.00<br>- 0.12<br>36.70<br>4.50 |               |
|                                       | POTASSIUM<br>SODIUM                                   | K +1<br>NA+1                 | MG/L<br>MG/L=                |                         |                      | 2.20<br>82.00                     | 1614061.      |
| * * * * * * * * * * * * * * * * * * * | ANIONS  | d n                          |                              |                         |                      |                                   |               |
| W E                                   | BICARBONATE<br>CARBONATE                              | HC03-1<br>C03 -2             | MG/L<br>MG/L                 |                         | -                    | 426.82<br>.0.11                   |               |
|                                       | CHLORIDE<br>FLUORIDE<br>HYDROXIDE                     | OH -1                        | MG/L<br>MG/L<br>MG/L         | *                       | e) e(mese ii         | 46.00<br>0.14<br>0.00             |               |
| 2<br>660 - 6                          | NITRATE<br>PHOSPHATE<br>SULFATE                       | NO3 -1<br>FO4 -3<br>SO4 -2   | MG/L<br>MG/L<br>MG/L         |                         |                      | 0.00<br>0.92<br>95.00             |               |
|                                       | SILICATE  | SID4-4                       | MG/L                         | SI02                    | MG/L                 | 0.02<br>                          |               |
|                                       | TOTAL FREE CARB<br>EQUILIBRIUM CAR<br>TOTAL DISSOLVED | BON DIOX                     |                              | CO2<br>CO2              | MG/L<br>MG/L<br>MG/L | 605.20<br>122.72<br>840.05        |               |
| <del></del>                           | TOTAL ALKALINIT<br>CALCIUM ALKALIN<br>MAGNESIUM ALKAL | Y<br>ITY                     | AS<br>AS<br>AS               | CACO3                   | MG/L<br>MG/L<br>MG/L | 349.94<br>335.00<br>14.94         |               |
|                                       | SODIUM ALKAZINI<br>TOTAL HARDNESS<br>CALCIUM HARDNES  |                              | AS<br>AS<br>AS               | E00A0<br>E00A0          | MG/L<br>MG/L<br>MG/L | 0.00<br>485.28<br>335.00          |               |
|                                       | MACHESIUM HARDN<br>NON-CARBONATE H                    | ESS<br>MRIKISS               | AS<br>AS                     | CAC03                   | MG/L<br>MG/L         | 150.94<br>135.33                  | 2             |
|                                       | CALCIUM NO.WECAR<br>NAONESIUM NON-C<br>PH             | ARI-QN/.TE                   |                              | CTINU                   | MG/L<br>MC/L         | 135.89<br>6.40                    | 17.           |
|                                       | EQUILIBRIUM TH<br>STABILITY INDEX<br>SATURATION INDE  |                              | FH<br>FH<br>FH               | UNITS<br>UNITS<br>2TINU |                      | 6.92<br>7.43<br>0.52              |               |
|                                       | TEMEGRATURE CONDUCTIVITY, K                           | DĀĒGK<br>CASURJI             | EES FAHS                     | ENMEIT                  |                      | 68.00<br>1450.00                  |               |
|                                       | IDRIC STRENGTH<br>ION BALANCE ERR                     |                              | ENT) ACTI                    | DITY CO                 | nrecte!              | 0.0179<br>i 4.41                  | 8.5           |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

TABLE F-5
CHEMICAL ANALYSES

Observation Well: OWC - 6

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-26-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: |5:10

|   |  |  | -  |
|---|--|--|--|
| ANALYSIS  | CONCENTRATIO   |  | ANALYST BOOK/PAGE  |
| LAB NUMBER: 8102-0700A  | SAMPLE DESCRIPTI   | ION: OWE-6 CHEVEON   | 4  |
|   | SPECIAL INSTRUCT   | TIONS: FILTER GLAS   | S FIBER  |
| DATE SAM LED  | 2/24/81  |  | ,  |
| TIME SAMPLED  | 15:10  |  | /  |
| ALDRIN<br>CHLORDANE   | 6.94   | UG/L   |  |
| 4+4-EDD   | ND(1.0)  | UG/L   | CJB 132 / 21<br>CJB 132 / 21   |
| 4+4-BDE   | 2.53<br>ND(0.20)   | UGZL   | - CJB 132 / 21-  |
| 4 - 4 - DITT  | 0.96   | UD/L   | CUB 132 / 21   |
| DIELDRIN  | 3.89   | UG/L<br>UG/L<br>UG/L   | CJR 132 / 21   |
| ENDRIN  | NE(0.40)   | UG/L   | -CJR 132 /- 21<br>PKS 132 / 21   |
| MEFTACHLOR<br>MALATHION   | 4.52   | 00/L   | CJB 132 -/ 21  |
| SEVIN   | ND(2.0)  | UG/L<br>• UG/L   | CJB 132 / 23   |
| 2,4,5-T   | **D(0.1)   | UG/L   | CJR - 132 / 21-<br>CJR 132 / 22  |
| TOXAPHENE   | ND(10.0)   | - HGZI   | - CJB 132 ≠ 21-  |
| PCB<br>LINDANE  | 1600   | UG/L<br>UG/L<br>UG/L   | CJB 132 / 21   |
| METHOXYCHLOR  | 43.2<br>ND(0.8)  | UG/L   | CJB 132 / 21<br>CJB - 132 / 21   |
| 2,4-D   | 1.1  | UG/L   | CJB 132 / 21   |
| MIREX   | ND(0.5)  | UG/L   | CJB 132 / 21-<br>CJB 132 / 21  |
| CAPTAN<br>DIFOLATAN   | ND(0.20)   | UG/L   | O.IB 4304. 21  |
| CHLOROBENZILATE   | ND(20)<br>ND(0.30)   | UG/L   | CJB 132 / 21<br>CJB 132 / 21<br>CJB 132 / 23   |
| GUTHION   | ND(100)  |  | CJB 132 / 21   |
| DIAZINON  | 27.3   | UG/L   | C IB - 132 / 23  |
| PARATHION, METHYL   | 2.2  | UG/L<br>UG/L<br>- UG/L   | CJB - 132 / 23<br>CJB 132 / 23   |
| PARATHION, ETHYL  | 0.8  | - UGAL =   | CJR132-/- 23-  |
|   |  |  |  |
| TRITHION PHOSDRIN (MEVINPHOS)CONCLUSIONLAB NUMBER   | 2.3<br>: 6102-0700A  | ne\r<br>ne\r   | CJB 132 / 21<br>CJB - 132-/ 23   |
| LAB NUMBER: 8102-0700B  | SAMPLE DESCRIPTI   | 06/L   | CJB 132 / 21<br>CJB 132 / 23   |
| LAB NUMBER: 8102-0700B  | SAMPLE DESCRIPTI   | ON: OWC-4 CHEVRON IONS: FILTEREI: IN   | CJB 132 / 21<br>CJB 132-/ 23   |
| LAB NUMBER: 8102-0700B  ARSENIC CADMIUM   | SAMPLE DESCRIPTI   | . UG/L UG/L ON: OWC-6 CHEVRON IONS: FILTEREI: IN MG/L  | CJB 132 / 21<br>CJB - 132-/ 23   |
| LAB NUMBER: 8102-0700B  ARSENIC CABMIUM COPPER  | SAMPLE DESCRIPTI STECIAL INSTRUCT  0.056 0.0021 0.0018   | . UG/L UG/L ON: OWC-6 CHEVRON IONS: FILTEREN: IN MG/L MG/L MG/L  | CJB 132 / 21<br>CJB - 132 / 23<br>FIELD  RTF - 131 / 50<br>RCR 130 / 196   |
| LAB NUMBER: 8102-0700B  ARSENIC CADMIUM COPPER ZINC   | SAMPLE DESCRIPTI<br>STECIAL INSTRUCT<br>0.056<br>0.0021<br>0.0018  | . UG/L UG/L ON: OWC-6 CHEVRON IONS: FILTEREI: IN MG/L  | CJB 132 / 21<br>CJB - 132 / 23<br>FIELD  ITT - 131 / 50<br>RCR 130 / 196<br>- RCR 130 / 200  |
| LAB NUMBER: 8102-0700B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: 8:02-0700C  | SAMPLE DESCRIPTI CONTROL  CONT | ON: OWC-4 CHEVRON IONS: FILTEREN: IN MG/L MG/L MG/L MG/L MG/L  | FIELD  RTF - 131 / 50 RCR 130 / 196 -RCR - 130 / 192 RCR 130 / 192   |
| LAB NUMBER: 8102-0700B  ARSENIC CAUMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: 8:62-6700C  | SAMPLE DESCRIPTI COURT OF THE STREET OF THE  | . UG/L UG/L ON: OWC-4 CHEVRON IONS: FILTEREI: IN MG/L MG/L MG/L MG/L MG/L ON: OWC-6 CHEVRON IONS: NO PREF  | FIELD  FIELD  ATT - 131 / 50  RCR 130 / 196  RCR - 430 / 200  RCR 130 / 192  |
| LAB NUMBER: 8102-0700B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER  LAB NUMBER: 8:62-6700C  ALKALINITY, TOTAL  | SAMPLE DESCRIPTI STECIAL INSTRUCT  0.056 0.0021 0.0018 0.039 18102-0700R  SAMPLE DESCRIPTI   | ON: OWC-4 CHEVRON IONS: FILTEREN IN MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD  FIELD  ATT - 131 / 50  RCR 130 / 196  -RGR - 430 / 200  RCF 130 / 192   |
| LAR NUMBER: 8102-0700B  ARSENIC CABMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAR NUMBER: 8:02-0700C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITKATIC   | SAMPLE DESCRIPTI STECIAL INSTRUCT  0.056 0.0021 0.0018 0.039 18102-0700R  SAMPLE DESCRIPTI   | ON: OWC-4 CHEVRON IONS: FILTEREI: IN MG/L MG/L MG/L MG/L ON: OWC-4 CHEVRON IONS: NO PREF MG/L, AS CACO3 MG/L   | FIELD  FIELD  HTF - 131 / 50  RCR 130 / 196  -RGR 430 / 200  RCF 130 / 192  BLD 47 / 91  CJA 82 -/ 32  |
| LAB NUMBER: 8102-0700B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: 8:02-0700C  ALKALINITY, TOTAL CALCIUM, EY EDTA TITRATIC CHLORIDE FLUORIDE   | SAMPLE DESCRIPTI<br>0.056<br>0.0021<br>0.0018<br>0.039<br>\$8102-0700R<br><br>SAMPLE DESCRIPTIONS<br>140<br>107<br>116<br>0.195  | ON: OWC-4 CHEVRON IONS: FILTEREE IN MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD  FIELD  RTF - 131 / 50 RCR 130 / 196 -RGR430 / 200 RCF 130 / 192   |
| ARSENIC CABMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: 8:02-0700C ALKALINITY, TOTAL CALCIUM, BY EDTA TITRATIC CHLORIDE FLUORIDE FRON, TOTAL  | SAMPLE DESCRIPTI<br>STECIAL INSTRUCT<br>0.056<br>0.0021<br>0.0018<br>0.039<br>: 8102-0700R<br>   | ON: OWC-4 CHEVRON IONS: FILTEREN IN MG/L MG/L MG/L MG/L ON: OWC-4 CHEVRON IONS: NO PREF MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD  FIELD  RTF - 131 / 50 RCR 130 / 196 -RGR 430 / 200 RCF 130 / 192  BLD 47 / 91 CJA 82 / 32 BLD 108 / 35 CJA 25 / 94 RCR 130 / 186  |
| ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: 8:02-0700C  ALKALINITY, TOTAL CALCIUM, FY EDTA TITRATIC CHLORIDE FLUORIDE IRON, TOTAL MAGNESIUM   | SAMPLE DESCRIPTI<br>STECIAL INSTRUCT<br>0.0016<br>0.0021<br>0.0018<br>0.039<br>: 8102-0700R<br>  | ON: OWC-4 CHEVRON IONS: FILTEREI: IN MG/L MG/L MG/L MG/L ON: OWC-4 CHEVRON IONS: NO PREF MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD  FIELD  RTF - 131 / 50 RCR 130 / 196 - RCR - 130 / 200 RCF 130 / 192  BLD 47 / 91 - CJA- 82 / 32 BLD 108 / 35 CJA 25 / 94 RCR 130 / 186  |
| ARSENIC CABMIUM COFFER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: 8:02-0700C ALKGLINITY, TOTAL CALCIUM, BY EDTA TITKATIC CALCIUM, BY EDTA TITKATIC CALCIUM, TOTAL MAGGANESE NITRATE   | SAMPLE DESCRIPTI<br>0.056<br>0.0021<br>0.0018<br>0.039<br>: B102-0700R<br><br>SAMPLE DESCRIPTIONS PROCESSED 140<br>0.107<br>116<br>0.195<br>0.26<br>26<br>3.00   | ON: OWC-4 CHEVRON IONS: FILTEREI: IN MG/L MG/L MG/L MG/L MG/L ON: OWC-4 CHEVRON IONS: NO PREF MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD  FIELD  HTF - 131 / 50 RCR 130 / 192   |
| ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: 8:02-0700C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRATIC CHLORIDE IRON, TOTAL MAGNESIUM MANGANESE NITRATE DRITHOFHOSPHATE  | SAMPLE DESCRIPTI<br>STECIAL INSTRUCT<br>0.056<br>0.0021<br>0.0018<br>0.039<br>: 8102-0700R<br>   | ON: OWC-4 CHEVRON IONS: FILTEREI: IN MG/L MG/L MG/L MG/L ON: OWC-4 CHEVRON IONS: NO PREF MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD    HTF - 131 / 50     RCR   130 / 196     RCR   130 / 196     RCR   430 / 200     RCR   130 / 192     RCR   130 / 192     RLD   47 / 91     CJA 82 / 32     RLD   108 / 35     CJA   25 / 94     RCR   130 / 186     RCR   130 / 186     RCR   130 / 196     CJA - 109 / 32 / 32     CJA - 109 / 32 / 32     RCR   130 / 196     CJA - 109 / 32 / 32 / 32     RCR   130 / 196     CJA - 109 / 32 / 32 / 32 / 32 / 32 / 32 / 32 / 3 |
| ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: \$:02-07000  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRATIO CHLORIDE FLUORIDE FLUORIDE IRON, TOTAL MAGNESIUM MANGANESE NITRATE ORTHOPHOSPHATE PH   | SAMPLE DESCRIPTI<br>STECIAL INSTRUCT<br>0.0056<br>0.0021<br>0.0018<br>0.039<br>: 8102-0700R<br>  | ON: OWC-4 CHEVRON IONS: FILTEREI: IN  MG/L  MG/L  MG/L  MG/L  MG/L  MG/L  AS P | FIELD  FIELD  RTF - 131 / 50 RCR 130 / 196 - RGR - 130 / 200 RCF 130 / 192  BLD 47 / 91 - CJA- 82 / 32 BLD 108 / 35 CJA 25 / 94 RCR 130 / 186 RCR 130 / 186 - CJA - 109 / 32 RLD 128 / 9 LKN 83 / 76   |
| LAB NUMBER: 8102-0700B  ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: 6:02-0700C  ALKALINITY, TOTAL CALCIUM, BY EDTA TITRATIC CHLORIDE FLUORIDE FLUORIDE IRON, TOTAL MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM                                  | SAMPLE DESCRIPTI<br>0.056<br>0.0021<br>0.0018<br>0.039<br>: 8102-0700R<br><br>SAMPLE DESCRIPTING<br>0.039<br>: 8102-0700R<br><br>SAMPLE DESCRIPTING<br>SPECIAL INSTRUCT:<br>140<br>0.195<br>0.26<br>26<br>3.00<br>0.9<br>0.05<br>6.20<br>1.6   | ON: OWC-4 CHEVRON IONS: FILTEREI: IN MG/L MG/L MG/L MG/L MG/L MG/L MG/L AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | ELD 47 / 91  |
| LAB NUMBER: 8102-0700B  ARSENIC CAUMIUM COPPER ZINCCONCLUSIONLAB NUMBER CALCIUM, FY EDTA TITRATIC CALCIUM, FY EDTA TITRATIC CHLORIDE FLUORIDE FLUORIDE IRON, TOTAL MAGNESIUM MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM SOLIUM                                 | SAMPLE DESCRIPTI<br>0.056<br>0.0021<br>0.0018<br>0.039<br>: 8102-0700R<br><br>SAMPLE DESCRIPTION<br>0.039<br>: 8102-0700R<br><br>SAMPLE DESCRIPTION<br>SPECIAL INSTRUCT:<br>140<br>9N 107<br>116<br>0.195<br>0.26<br>26<br>3.00<br>0.9<br>0.05<br>6.20<br>1.6<br>16  | ON: OWC-4 CHEVRON IONS: FILTEREN IN MG/L MG/L MG/L MG/L MG/L MG/L AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | BLD 47 / 91 - CJA - 130 / 192  BLD 47 / 91 - CJA - 82 / 32 BLD 108 / 35 CJA 25 / 94 RCR 130 / 196 RCR 130 / 196 RCR 130 / 196 RCR 130 / 196 RCR 130 / 196 RCR 130 / 196 RCR 130 / 196 RCR 130 / 186 RCR 130 / 186 RCR 130 / 186 RCR 130 / 186 RCR 130 / 186 RCR 130 / 186 RCR 130 / 186 RCR 130 / 186 RCR 130 / 186 RCR 130 / 186 RCR 130 / 188 RCR - 130 / 188  |
| LAB NUMBER: 8102-0700B  ARSENIC CAUMIUM COPPER ZINCCONCLUSIONLAB NUMBER LAB NUMBER: 8:02-0700C  ALKALINITY, TOTAL CALCIUM, FY EDTA TITRATIO CHLORIDE FLUORIDE FLUORIDE HADORIDE MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM SULICON SUDIUM SPECIFIC CONDUCTANCE | SAMPLE DESCRIPTI<br>STECIAL INSTRUCT<br>0.056<br>0.0021<br>0.0018<br>0.039<br>: 8102-0700R<br><br>SAMPLE DESCRIPTING<br>SPECIAL INSTRUCT:<br>140<br>9N 107<br>116<br>0.195<br>0.26<br>26<br>3.00<br>0.9<br>0.05<br>6.20<br>1.6<br>16<br>33<br>1060   | ON: OWC-4 CHEVRON IONS: FILTEREI: IN MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD  RITF - 131 / 50 RCR 130 / 196 RCR 130 / 196 RCR 130 / 192  BLD 47 / 91 - CJA - 82 / 32 BLD 108 / 35 CJA 25 / 94 RCR 130 / 186 RCR 130 / 190 RCR 130 / 190 RCR 130 / 186 CJA - 109 / 32 RLD 128 / 9 LKN 83 / 76 RCR 130 / 188 RCR - 130 / 188 RCR - 130 / 188 RCR - 130 / 188 RCR - 130 / 188  |
| LAB NUMBER: 8102-0700B  ARSENIC CAUMIUM COPPER ZINCCONCLUSIONLAB NUMBER CALCIUM, FY EDTA TITRATIC CALCIUM, FY EDTA TITRATIC CHLORIDE FLUORIDE FLUORIDE IRON, TOTAL MAGNESIUM MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM SOLIUM                                 | SAMPLE DESCRIPTI<br>STECIAL INSTRUCT<br>0.056<br>0.0021<br>0.0018<br>0.039<br>: 8102-0700R<br><br>SAMPLE DESCRIPTING<br>SPECIAL INSTRUCT:<br>140<br>9N 107<br>116<br>0.195<br>0.26<br>26<br>3.00<br>0.9<br>0.05<br>6.20<br>1.6<br>16<br>33<br>1060   | ON: OWC-4 CHEVRON IONS: FILTEREN IN MG/L MG/L MG/L MG/L MG/L MG/L AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | BLD 47 / 91  |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

TABLE F-5
CHEMICAL ANALYSES

Observation Well: OWC - 6

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-26-81

Sampled by:

- I ARRESTORY - ----

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: 15:10

STANDARD -CHEMICAL -WATER -ANALYSIS -

DATE: 13 MARCH 1981 mg a --- -- --

LABORATORY FILE NO.: -81-9521 - -LABORATORY NO.: 8102-0700C
--SAMPLE RECEIVED -26 FEBRUARY 1981

| CATIONS                          |               | VIII.//(1446-14 |                    | 1 201255         | ANALYSIS              |    |
|----------------------------------|---------------|-----------------|--------------------|------------------|-----------------------|----|
| CALCIUM                          | CA+2          |                 |                    |                  | 107.00                | ,  |
| IRON                             | FE+2 - =      | -MG/L -         |                    |                  |                       |    |
| KAGNESIUM                        | MG+2          | MG/L            |                    |                  | 26.00<br>3.00<br>1.60 |    |
| MANGANESE                        | MN+2          | MG/L            |                    |                  | 3.00                  |    |
| POTASSIUM                        | K +1          | MG/L            |                    |                  | 1.60                  |    |
| SODIUM                           | NA+1          | MG/L -          | -                  |                  | 33.00                 |    |
| ANIONS                           | 1777-70-2     |                 |                    |                  |                       |    |
| BICARBONATE                      | HC03-1        | MG/L            |                    |                  | 170.76                |    |
| CARBONATE                        | CO3 -2        |                 |                    | 45 <del></del> - | -0.03                 |    |
| CHLORIDE                         | CL -1         | MG/L            |                    |                  | 116.00                |    |
| FLUORIDE                         | F ==1-        | MG/L-           |                    |                  |                       |    |
| HYDROXIDE                        | OH -1         | MG/L            |                    |                  | 0.00                  |    |
| NITRATE                          | NO3 -1        | MG/L -          |                    |                  | 3-99                  |    |
| PHOSPHATE                        | F04 -3        | MG/L            |                    |                  | 0.15                  |    |
| SULFATE -                        |               |                 |                    | 55               |                       |    |
| SILICATE                         | SI044         |                 |                    | 1073 Process (1  | 0.01                  |    |
| SILICA                           |               |                 | S102               | MG/L             | 34.24                 |    |
| TOTAL FREE CAR                   | BON DIOXI     | DE              | - G02-             | MG/L -           | 373 <del>-66</del>    |    |
| EQUILIBRIUM CA                   |               |                 |                    |                  |                       |    |
|                                  |               |                 |                    |                  | 638+43                | *1 |
| TOTAL ALKALINI                   |               |                 | S CACO3            |                  | 139.95<br>139+95      |    |
| CALCIUM ALKALI                   |               |                 |                    |                  |                       |    |
| MAGNESIUM ALKA<br>SODIUM ALKALIN |               | FI:             | 5 CACO3<br>5 CACO3 | 1107L            | 0.00                  |    |
| TOTAL MARGNERS                   |               | A:              |                    |                  | 373,90                |    |
| TOTAL HARDNESS                   |               |                 | S CACO3            | MG /I            | 267.50 ==             |    |
| HACKESIUM HARI                   | NEGE          | - 11            | 20000 C            | MG/L             | 106.86                |    |
| MONEGIOT TAKE                    | NATE DATECT   |                 | 5 .04003           | MG/L             | 233+95                | 2  |
| CALCIUM NON-CA                   |               |                 |                    | MG/L             |                       |    |
| MAGNESTHM NOW                    | CARBONATE     | HARDNES         | R54                | MBZ!             | 106+86                |    |
| PH                               | GIII(E:CHIII) |                 | H UNITS            |                  | 5.20                  |    |
|                                  | (PHS)         | 121             | HELINITS           | 6.0              |                       |    |
| STABILITY INDE                   |               | F1              | H UNITS            |                  | 8.40                  |    |
| SATURATION IN                    |               |                 | H_UNITS            |                  | 1.20                  |    |
| TEMPEDATURE                      | T.E.G.I       | REES EAS        | носинетт           |                  | 68.00                 |    |
| CONDUCTIVITY.                    | HEASURED.     | - MICR          | OMHOS/CM           |                  | _ = 1060-00           |    |
| TONIC STEEDSTE                   | I (MOLAR)     |                 |                    |                  | 0.0144                |    |
| ION BALANCE ER                   | ROR (PER      | CENT) - BY      | CONCENT            | RATION           | 0.53                  |    |
|                                  |               |                 |                    |                  |                       |    |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45,4 membrane) and acid preserved in the field.

# TABLE F-6 CHEMICAL ANALYSES

Observation Well: OWC - 7

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories Salina, Kansas

File No. 81-9521

Date Received: 2-26-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: 13:45

| ANGL YSIS   | CONCENTRATION  | UNITS   | ANALYST BOOK/PAG  |
|---|--|---|---|
| LAB NUMBER: 8102-0701A SAH  | PLE DESCRIPTION  | N: OWC-7 CHEVRON  |   |
| SFE   | CIAL INSTRUCTIO  | ONS: FILTER GLASS   | FIBER   |
| DATE SAMPLED  | 2/24/81  |   | 550-  |
| TIME SAMPLED  | 13:45  |   | /   |
| ALDRIN  | 63+3   | UG/L ===  | -CJB 132 /2   |
| CHLOCDANE   | ND(1.0)  | UG/L  | CJB 132 / 2   |
| 4+4-10DD  | NI(0.20)   | UGZL  | CJB 132 / 2   |
| 4,4-DDE   | ND(0.20)   | UG/L  | CJB 132 / 2   |
| 4 • 4 · DIDT  | ND(0.20)   | UG/L  | CJR 132 / 2   |
| DIELDRIN  | ND(0.50)   | UGZL  | CJB 132 / 2   |
| ENDRIN  | HII(0.40)  | UG/L  | - 8 BKS 132 √ 2   |
| HELTACHLOR  | ND(0.10)   |   | CJB 132 / 2   |
| MALATHION   |  | UGZL  | CJD 132 / 2   |
| SEVIN   | NOT AMEL.  | UGZL  | CJB 132 / 2   |
| 2,4,5-T   | 0.2  | UG/L  | CJB 132 / 2   |
| TOXAFHENE   | ND(10.0)   | UG/L  | CJB 132 / 2   |
| PCB   | ND(10.0)   | UG/L  | = - CJR 132 / 2   |
| LINDANE   | 1880   | UG/L  | CJB 132 / 2   |
| METHOXYCHLOR  | ND(0.8)  | UG/L  |   |
| 2 • 4 - D   | 2.6  |   | CJB 132 / 2<br>   |
| MIREX   |  | UG/L  |   |
| CAPTAN  | NE(0.20)   |   | UJB 132 / 2   |
| DIFOLATAN   | NE(20)   | HEZE  | CJB 132 / 2<br>CJB 432 / 2<br>CJB 132 / 2   |
| CHLOROBENZILATE   | ND(0.30)<br>ND(100)  | UG/L  | CJB 132 / 2   |
| GUTHION   | NTI (100)  | UG/L  | CJB 132 / 2   |
| PIAZINON  | 427  | UG/L  | CJF132- ✓ 2   |
| PARATHION, METHYL   | 6.1  | UG/L  | C.D. 470 / 5  |
| PARATHION, ETHYL  |  | UG/L  | CJR 132 / 2<br>-CJR 132 / 2   |
| TETTITON  |  | HEN   | C ID 170 / 2  |
| PHOSDRIN (MEVINPHOS)  | 7.9  | UD (I   | CJD 132 / 2   |
| CONCLUSION LAR NUMBER: 8  | 102-0701A  | UG/L  | CJB132/ 2   |
| CONCLUSIONLAB NUMBER: 8   | 102-0701A  | 06/L  | CJB 132 / 2<br>- CJB -132 / 2   |
| LAB NUMBER: 8102-0701B SAM  | 102-0701A<br><br>PLE DESCRIPTION   |   |   |
| LAB NUMBER: 8102-0701B SAM  | 102-0701A<br><br>PLE DESCRIPTION   |   |   |
| LAB NUMBER: 8102-0701B SAM  | TLE DESCRIPTION  | N: OWC-7 CHEVRON<br>ONS: FILTERED IN F  | TELD  |
| LAB NUMBER: 8102-0701B SAMI   | FLE DESCRIPTION  | N: OWC-7 CHEVRON<br>DNS: FILTERED IN F  | IELD BIF 131 5  |
| LAB NUMBER: 8102-0701B SAMI SPEC  | FLE DESCRIPTION TIAL INSTRUCTION 0.13  | N: OWC-7 CHEVRON<br>OMS: FILTERED IN F<br>- MG/L<br>MG/L  | BIF 131 5   |
| LAB NUMBER: 8102-0701B SAMI SPECE ARSENIC CADMIUM COPPER ZINC   | 0.13 0.012 0.096 0.34  | N: OWC-7 CHEVRON<br>ONS: FILTERED IN F<br>- MG/L<br>MG/L<br>MG/L  | RELE 131 5 3 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  |
| LAB NUMBER: 8102-0701B SAMI SPECARSENIC CADMIUM COPPER  | 0.13 0.012 0.096 0.34  | N: OWC-7 CHEVRON<br>OMS: FILTERED IN F<br>- MG/L<br>MG/L  | TELD  TER 131 5  TCR 130 / 1  RCR 130 / 1   |
| LAB NUMBER: 8102-0701B SAMI SPENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8   | 0.13<br>0.012<br>0.012<br>0.36<br>102-07018  | N: OWC-7 CHEVRON<br>DNS: FILTERED IN F<br>- MG/L<br>MG/L<br>MG/L<br>MG/L  | BIF 131 5<br>3CR 130 / 1<br>- RCR 130 / 1<br>RCR 130 / 1  |
| LAB NUMBER: 8102-0701B SAMI SPECE CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: LAB NUMBER: 8: LAB NUMBER: 8: SPECE SAMI SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SPECE SAMI SAMI SAMI SAMI SAMI SAMI SAMI SAMI   | 0.13<br>0.012<br>0.012<br>0.36<br>102-07018  | N: OWC-7 CHEVRON ONS: FILTERED IN F - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L  | BIF 131 5<br>3CR 130 / 1<br>RCR 130 / 1<br>RCR 130 / 1  |
| LAB NUMBER: 8102-0701B SAMI SPECE ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: 8: 2010 SAMI SPECE ALEALINITY, TOTAL  | TLE DESCRIPTION  0.13 0.012 0.096 0.36  102-0701B  TLE DESCRIPTION CIAL INSTRUCTION CIAL INSTRUCTION CIAL INSTRUCTION 320  | N: OWC-7 CHEVRON ONS: FILTERED IN F - MG/L - MG/L MG/L MG/L N: OWC-7 CHEVRON ONS: NO PREP   | BIF 131 5 3CR 130 / 1 RCR 130 / 1 RCR 130 / 1   |
| ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: L/B NUMBER: 8102-0701B SAMI SPEI  L/B NUMBER: 8102-0701B SAMI SPEI  ALEGLINITY, TOTAL CALCIUM: BY LUTA TITRATION  | FLE DESCRIPTION  O.13 O.012 O.096 O.36 102-07018  FLE DESCRIPTION CIAL INSTRUCTION CIAL INSTRUCTION 320 137  | N: OWC-7 CHEVRON ONS: FILTERED IN F - MG/L - MG/L - MG/L - MG/L - N: OWC-7 CHEVRON ONS: NO PREF - MG/L, AS CACO3 - MG/L   | BIF 131 5<br>3CR 130 / 1<br>RCR 130 / 1<br>RCR 130 / 1<br>RCR 130 / 1   |
| LAB NUMBER: 8102-0701B SAMI SPECE  ARSENIC CADMIUM COPFER ZINCCONCLUSIONLAB NUMBER: 8:  L/B NUMBER: 8102-0701C SAMI SPECE SAMI SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SPECE SECOND SEC | FLE DESCRIPTION  O.13 O.012 O.096 O.36 102-07018  FLE DESCRIPTION CIAL INSTRUCTION CIAL INSTRUCTION 320 137  | N: OWC-7 CHEVRON ONS: FILTERED IN F - MG/L - MG/L - MG/L - MG/L - N: OWC-7 CHEVRON ONS: NO PREF - MG/L, AS CACO3 - MG/L   | BIF 131 5<br>3CR 130 / 1<br>RCR 130 / 1<br>RCR 130 / 1<br>RCR 130 / 1   |
| LAB NUMBER: 8102-0701B SAMI SPECE ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: L/B NUMBER: 8: SPECE ALEALINITY, TOTAL CALCIUM. BY LUTA TITRATION CHECKIDE CHECKIDE CHECKIDE CHECKIDE   | 102-0701A  FLE DESCRIFTION CIAL INSTRUCTION 0.13 0.012 0.096 0.36 102-0701B  FLE DESCRIFTION CIAL INSTRUCTION 320 137 296 0.245                                  | N: OWC-7 CHEVRON ONS: FILTERED IN F - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - AS CACO3 - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L  | BIF 131 5<br>RCR 130 / 1<br>RCR 130 / 1<br>RCR 130 / 1<br>RCR 130 / 1   |
| LAB NUMBER: 8102-0701B SAMI SPECAMENTO CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: CALEALINITY, TOTAL CALEATUM. BY EDTA TITRATION CHECKIBE CHE | 102-0701A  FLE DESCRIPTION  0.13 0.012 0.096 0.36  102-0701B  FLE DESCRIPTION  CIAL INSTRUCTION  320 137 296 0.245 0.69  | N: OWC-7 CHEVRON ONS: FILTERED IN F - MG/L - MG/L - MG/L - MG/L - N: OWC-7 CHEVRON ONS: NO PREF - MG/L, AS CACO3 - MG/L   | BIF 131 5 3CR 130 / 1 RCR 130 / 1 RCR 130 / 1 RCR 130 / 1 RCR 130 / 1  BLII 47 / 9 C. 14 62 / 3 BLII 108 / 3 CJA 25 / 9 ECE 130 / 1   |
| ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: L/B NUMBER: 8102-0701B SAMI SPEI ALEALINITY, TOTAL CALCIUM: BY EDTA TITRATION CHECKIDE CHUCKIDE TEUGRIBE IEON: TOTAL MAGRESIUM  | 102-0701A  FLE DESCRIPTION  0.13  0.012  0.036  102-0701B  FLE DESCRIPTION  CIAL INSTRUCTION  320  137  296  0.245  0.69  58                                     | N: OWC-7 CHEVRON ONS: FILTERED IN F - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - AS CACO3 - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L  | BIF 131 5 3CR 130 / 1 RCR 130 / 1 RCR 130 / 1 RCR 130 / 1 RCR 130 / 1  BLII 47 / 9 C. 14 62 / 3 BLII 108 / 3 CJA 25 / 9 ECE 130 / 1   |
| LAB NUMBER: 8102-0701B SAMI SPECE CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: LAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUM | 102-0701A  PLE DESCRIPTION CIAL INSTRUCTION 0.13 0.012 0.096 0.36 102-0701B  PLE DESCRIPTION CIAL INSTRUCTION 137 296 0.245 0.69 58 14                           | N: OWC-7 CHEVRON ONS: FILTERED IN F MG/L MG/L MG/L MG/L N: OWC-7 CHEVRON ONS: NO PREP MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | BLD 47 / 9  BLD 47 / 9  C. 4 82 / 3  BLD 108 / 3  CJA 25 / 9  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1   |
| LAB NUMBER: 8102-0701B SAMI SPECADMILLO CADMILLO CADMILLO COPPER ZINCCONCLUSIONLAB NUMBER: 8: LAB NUMBER: RAB | 102-0701A  PLE DESCRIPTION CIAL INSTRUCTION 0.13 0.012 0.096 0.36 102-0701B  PLE DESCRIPTION CIAL INSTRUCTION 137 296 0.245 0.69 58 14                           | N: OWC-7 CHEVRON ONS: FILTERED IN F MG/L MG/L MG/L MG/L N: OWC-7 CHEVRON ONS: NO PREP MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | BLD 47 / 9  BLD 47 / 9  BLD 47 / 9  BLD 108 / 3  BLD 108 / 3  BLD 108 / 3  CJA 25 / 9  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  |
| LAB NUMBER: 8102-0701B SAMI SPECE CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: LAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUMBER: RAB NUM | 102-0701A  FLE DESCRIFTION CIAL INSTRUCTION 0.13 0.012 0.096 0.36 102-0701B  FLE DESCRIFTION CIAL INSTRUCTION 320 137 296 0.245 0.69 58 14 NB(0.1)               | N: OWC-7 CHEVRON ONS: FILTERED IN F - MG/L   | BLD 47 / 9  CHARLES AND A 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  |
| LAB NUMBER: 8102-0701B SAMI SPECADMILLO CADMILLO CADMILLO COPPER ZINCCONCLUSIONLAB NUMBER: 8: LAB NUMBER: RAB | 102-0701A  FLE DESCRIFTION  0.13 0.012 0.096 0.36  102-0701B  FLE DESCRIFTION  CIAL INSTRUCTION  320 137 296 0.245 0.69 58 14 ND(0.1) 0.15                       | N: OWC-7 CHEVRON OMS: FILTERED IN F -MG/L | BLD 47 / 9 C. 130 / 1 RCR 130 / 1   |
| ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: LAB NUMBER: 8:02-0701B SAMI SPEI ALEALINITY, TOTAL CALCIUM: BY EDTA TITRATION CHECKIDE LUCARDE 180N: TOTAL MASSESIUM MA | 102-0701A  FLE DESCRIFTION  0.13 0.012 0.096 0.36  102-0701B  FLE DESCRIFTION  CIAL INSTRUCTION  320 137 296 0.245 0.69 58 14 ND(0.1) 0.15 6.30                  | N: OWC-7 CHEVRON ONS: FILTERED IN F - MG/L - MG/L - MG/L - MG/L - MG/L - MG/L - AS CACO3 - MG/L - AS P  | BLD 47 / 9 CM 52 / 30 / 1 RCR 130 / 1 RCR |
| LAB NUMBER: 8102-0701B SAMI SPECE ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: LAB NUMBER: 8: LAB NUMBER: 8: SPECE ALEGALINITY, TOTAL CALCIUM. BY EDTA TITRATION CHECKIDE FLUGATED LOON. TOTAL MAGGERES UM MAGGERES UM MAGGERES ENTRATE ORTHOGROSPHATE PH POTASSIUM  | 102-0701A  FLE DESCRIPTION  0.13 0.012 0.096 0.36  102-0701B  FLE DESCRIPTION  CIAL INSTRUCTION  320 137 296 0.245 0.69 58 14 ND(0.1) 0.15 6.30 5.5              | N: OWC-7 CHEVRON ONS: FILTERED IN F MG/L MG/L MG/L N: OWC-7 CHEVRON ONS: NO PREP MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | BLD 47 / 9  BLD 47 / 9  CH 62 / 3  BLD 108 / 3  BLD 108 / 3  BLD 108 / 3  BLD 108 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  |
| LAB NUMBER: 8102-0701B SAMI SPECAMENTO CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: CALEALINITY, TOTAL CALEATION BY EDTA TITRATION CHECKIBE CHE | 102-0701A  PLE DESCRIPTION CIAL INSTRUCTION 0.13 0.012 0.096 0.36 102-0701B  PLE DESCRIPTION CIAL INSTRUCTION 320 139 296 0.245 0.69 58 14 ND(0.1) 0.15 6.30 5.5 | N: OWC-7 CHEVRON ONS: FILTERED IN F -MG/L -MG/L -MG/L -MG/L -MG/L -N: OWC-7 CHEVRON ONS: NO PREP -MG/L  | BLD 47 / 9  BLD 47 / 9  CH 62 / 3  BLD 108 / 3  BLD 108 / 3  BLD 108 / 3  BLD 108 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  BLD 109 / 3  |
| LAB NUMBER: 8102-0701B SAMI SPECAMENTO CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: CALEALINITY, TOTAL CALEATION BY EDTA TITRATION CHECKIBE CHE | 102-0701A  FLE DESCRIFTION  0.13 0.012 0.096 0.36  102-0701B  FLE DESCRIFTION  CIAL INSTRUCTION  320 137 296 0.245 0.69 58 14 NB(0.1) 0.15 6.30 5.5 11 114       | N: OWC-7 CHEVRON OMS: FILTERED IN F -MG/L MG/L MG/L MG/L MG/L N: OWC-7 CHEVRON OMS: NO PREP MG/L, AS CACO3 -MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | BLD   |
| LAB NUMBER: 8102-0701B SAMI SPEC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: CALCIUM: BY EDIA TITRATION CHECTIDE CLUCKIEC CALCIUM: BY EDIA TITRATION CHECTIDE CLUCKIEC CALCIUM: BY EDIA TITRATION CHECTIDE CLUCKIEC CALCIUM: BY EDIA TITRATION CHECTIDE CONTUCTION TOTAL CASCIUM CHECTION CONTUCTION CHECTION CHECTION CHECTION CHECTION CHECTION CHECTION CHECTION CHECTION CHECTION CHECTION CHECTION CHECTION CHECTION CHECTION CONTUCTANCE  | 102-0701A  FLE DESCRIPTION  0.13 0.012 0.096 0.36  102-0701B  FLE DESCRIPTION  CIAL INSTRUCTION  320 139 296 0.245 0.69 58 14 HD(0.1) 0.15 6.30 5.5 11 114 1060  | N: OWC-7 CHEVRON ONS: FILTERED IN F -MG/L MG/L MG/L MG/L N: OWC-7 CHEVRON ONS: NO PREP  MG/L, AS CACO3 -MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | BIF 131 5  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 1  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14  RCR 130 / 14   |
| LAB NUMBER: 8102-0701B SAMI SPECAMENTO CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8: CALEALINITY, TOTAL CALEATION BY EDTA TITRATION CHECKIBE CHE | 102-0701A  FLE DESCRIFTION  0.13 0.012 0.096 0.36  102-0701B  FLE DESCRIFTION  CIAL INSTRUCTION  320 137 296 0.245 0.69 58 14 NB(0.1) 0.15 6.30 5.5 11 114       | N: OWC-7 CHEVRON OMS: FILTERED IN F -MG/L MG/L MG/L MG/L MG/L N: OWC-7 CHEVRON OMS: NO PREP MG/L, AS CACO3 -MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | BIF 131 5  RCR 130 / 1  |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

### TABLE F-6 CHEMICAL ANALYSES

Observation Well: OWC - 7

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-26-81

Sampled by:

\_\_\_\_LADORATORY----

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: 13:45

#### - STANDARD-CHEMICAL WATER ANALYSIS

- DATE: 13 MARCH 1981

- LAPORATORY FILE NO.: 81:9521 LABORATORY NO.: 8102-0701C -SAMPLE RECEIVED 26 FEBRUARY 1981

| CATIONS           |                 |          |             |        |              | ANALYSIS         |                 |      |
|-------------------|-----------------|----------|-------------|--------|--------------|------------------|-----------------|------|
| CALCIUM           | CA+2            | MG/L     | 25211111    |        |              | 139.00           |                 | 7.5  |
| IRON -            | FE+2            | MG/F     |             |        |              | 0.45             |                 | -    |
| MAGNESIUM         | MG+2            | MG/L     |             |        |              | 58.00            |                 |      |
| MANGANESE         | MN+2 -          | MG/L     |             |        |              | 14-00-           |                 |      |
| POTASSIUM         | K 41            | MG/L     |             |        |              | 5.50             |                 |      |
| SODIUM            | NA+1            | MG/L     |             |        |              | 114-00           |                 |      |
| MARKE F NO W      |                 |          |             |        |              |                  |                 |      |
| ANIONS            | •               |          |             |        |              |                  |                 |      |
| BICARBONATE       | HC03-1          |          |             |        |              | 390.26           |                 |      |
| CARBONATE         | CO3 -2          |          |             |        |              | 0+10-            |                 |      |
| CHLORIDE          | CL -1           | MG/L     |             |        |              | 296.00           |                 |      |
| FLUORIDE          | F = 1-          |          | S (25)      | 0.75   |              | 0+24             |                 |      |
| HYDROXIDE         | OH -1           |          |             |        |              | 0.00             |                 |      |
| NITRATE           | NO3 -1          |          | 11111       |        |              | 0+-00            |                 | 5.70 |
| PHOSPHATE         | F04 -3          |          |             |        |              | 0.46<br>-220.00  |                 |      |
| SULFATE           | S04 -2          |          |             |        |              | 0.01             |                 |      |
| SILICATE          | SI04-4          | MU/L     |             |        |              | 0.01             |                 |      |
| SILICA            |                 |          |             | SI02   |              | 23.54            |                 |      |
| TOTAL FREE CARB   | IXOIG NO        | BE       |             | CO2 -  | MG/L         | -737-7-8         |                 |      |
| EQUILIBRIUM CAR   |                 |          |             | C02    | MG/L         | 99.91            |                 |      |
| TOTAL DISSOLVED   | SOLIDS          | (CAL     | <del></del> |        | MG/L · ·     | 1255+41          |                 |      |
| TOTAL ALKALINIT   |                 |          | AS          |        | MG/L         | 319.96           |                 |      |
| CALCIUM ALKALIN   |                 |          |             |        | -HC-1        |                  |                 | -    |
| MAGNESIUM ALKAL   |                 |          |             | CACO3  | MG/L         | 0.00             |                 |      |
| SODIUM ALKALINI   | TY              |          | AS          |        | MG/L         | 0.00             | 3 5 5 5 5       |      |
| TOTAL HARDNESS    | _               |          | AS          | CAC03  | MG/L<br>MG/L | 585.36<br>347.50 |                 |      |
| CALCIUM HARDNES   |                 | 2017     | AS -        | E00A0- |              | 238.38           |                 | 1.14 |
| MAGNESIUM HARDN   |                 |          | –           |        | MG/L         |                  |                 |      |
| NON-CARBONATE H   |                 |          |             | UHUU-  | MG/L         | 27.54            |                 |      |
| MACHIDIUM NON-C   |                 |          |             |        | MS/L         | = 238.38         |                 |      |
| FH                | mikts Office to | 11001111 | FH          |        | 1107 C.      | 6.30             |                 |      |
| EQUILIBRIUM PH    | CRHCY           |          |             | UNITS  |              | 6.96             | 0.0000 A. W. 10 |      |
| STATILITY INDEX   |                 | -        |             | UNITS  |              | 7.61             | 00-05-00 pt 50  |      |
| SATURATION INDE   |                 | 8110     |             | LINITS |              | 0.46-            |                 |      |
| TENDERATURE       |                 |          |             | TICHNE |              | 42,00            |                 |      |
| CONFUCTIVITY, M   |                 |          |             |        |              | 1030.00          | -02 - 17 (20)   | ā    |
| IONIC STRENGTH    |                 |          |             |        |              | 0.0268           |                 |      |
| ION BALANCE ERROR |                 | BY CO    | CENT        | RATION | 411.1        | -5.49            | 7               |      |
|                   | -               |          |             |        |              |                  |                 |      |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45 $\mu$  membrane) and acid preserved in the field.

TABLE F-7
CHEMICAL ANALYSES

Observation Well: OWC - 8

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-26-81

ANALYSIS

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: |3:10

ANALYST BOOK/PAGE

| DATE SAMPLED  | 2/24/81   |  |       |   | /   |
|---|---|--|-------|---|---|
| TIME SAMPLED  | 13:10   |  |       |   |   |
| ALDRIN  | 4.59  | UG/L   |       | CJB   | 132 / 21  |
| CHLORDANE   | -ND(1.0) -  |  |       |   | -132 / 21   |
| 4,4-DDD   | ND(0.20)  | UG/L   |       | CJB   | 132 / 21  |
| 4,4-DDE   | ND(0.20)  |  |       | C-JB  | 132 / 21  |
| 4,4-DDT   | NE(0.30)  | UG/L   |       | CJB   | 132 / 23  |
| DIELDRIN  |   | UG/L   |       |   | 132 / 21  |
| ENDRIN  | NI(0.40)  | UG/L   |       | BKS   | 132 / 21  |
| HEPTACHLOR  | ND(0.10)  | UG/L   | . 10  |   | 132 / 21  |
| MALATHION   | ND(2.0)   | UG/L   |       | CJB   | 132 / 23  |
| SEVIN<br>2,4,5-T  | NOT ANAL.   | UG/L   | -     |   | 132 / 21  |
| TOXAPHENE   | 9.7   | UG/L   |       | CJB   | 132 / 22  |
| FCB   | ND(10.0)  | UG/L   |       | CJB   | 132 / 21  |
| LINDANE   | ND(10.0)  | UG/L   |       | CJB   | 132 / 21  |
| METHOXYCHLOR  | 184<br>NB(0.8)  | UG/L   |       | -CJB  | 132 / 21  |
| 2 • 4II   |   | UG/L   |       | CJB   | 132 / 21  |
| MIREX   | 87.6  | UG/L   | -     |   | 132-/ 21-   |
|   | ND(0.5)   | UG/L   |       | CAB   | 132 / 21  |
| CAPTAN  | ND(0.20)  | UG/L   |       | CJB   | 132 / 21  |
| DIFOLATAN   | ND(20)  | UG/L   |       | CJB   | 132 / 21  |
| CHLOROBENZILATE   | ND(0.30)  | UG/L   |       | CAR   | 132 / 23  |
| GUTHION<br>DIAZINON   | ND(100)   | UG/L   |       | CTB   | 132 / 23  |
|   | 37.8  |  | - 1   |   | -132- / 23-   |
| PARATHION, METHYL   | 1.6   | UG/L   |       | CJB   | 132 / 23  |
| PARATHION, ETHYL  | 2.5   | UG/L   |       | CUB   | 132 / 23  |
| TRITHION  | NOT ANAL+   | UG/L   |       | CJB   | 132-/-21  |
| PHOSDRIN (MEVINPHOS)  | ND(2.0)   | UG/L   |       | DUB   | 132 / 23  |
| CONCLUSION LAB NUMBER: 8102-  | -0702A -  |  |       |   | -   |
|   |   |  |       |   |   |
| LAB NUMBER: 8102-0702B SAMPLE   |   | v: OWC-8 CHEVRON<br>DNS: FILTERED IN   |       |   | is to:  |
| LAB NUMBER: 8102-0702B SAMPLE   |   | DNS: FILTERED IN MG/L  | FIELD | BTF   | 131 / 51  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC GADMIUM   | 0.005<br>0.0010   | DNS: FILTERED IN MG/L  | FIELD | BTF   |   |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER  | 0.005<br>0.0010<br>0.0028   | MG/L MG/L MG/L MG/L MG/L   | FIELD | BTF<br>- RCR -<br>RCR   | 131 / 51<br>130 / 196<br>130 / 200  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINC   | 0.005<br>0.0010<br>0.0028<br>0.059  | MG/L MG/L  | FIELD | BTF<br>- RCR -<br>RCR   | 131 / 51<br>130 / 196<br>130 / 200  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER  | 0.005<br>0.0010<br>0.0028<br>0.059  | MG/L MG/L MG/L MG/L MG/L   | FIELD | BTF<br>- RCR -<br>RCR   | 131 / 51<br>130 / 196<br>130 / 200  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINC   | 0.005<br>0.0010<br>0.0028<br>0.059  | MG/L MG/L MG/L MG/L MG/L   | FIELD | BTF<br>- RCR -<br>RCR   | 131 / 51<br>130 / 196<br>130 / 200  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102   | 0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B  | MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD | BTF<br>- RCR -<br>RCR   | 131 / 51<br>130 / 196<br>130 / 200  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-  | 0.005<br>0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B   | MG/L MG/L MG/L MG/L MG/L MG/L MG/L   | FIELD | BTF<br>- RCR -<br>RCR   | 131 / 51<br>130 / 196<br>130 / 200  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-0702C SAMPLE SPECIAL  | 0.005<br>0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B   | ONS: FILTERED IN  MG/L  MG/L  MG/L  MG/L  -MG/L  -MG/L  -NG/L  -NG/L                                     | FIELD | BTF<br>- RCR -<br>RCR<br>- RCR  | 131 / 51<br>130 / 196<br>130 / 200  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-0702C SAMPLE SPECIAL  | 0.005<br>0.0010<br>0.0010<br>0.0028<br>0.059<br>-0702B  | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF<br>- RCR -<br>RCR<br>- RCR  | 131 / 51<br>130 / 190<br>130 / 200<br>130 / 199   |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-0702C SAMPLE SPECIAL ALKALINITY, TOTAL  | 0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B  | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF<br>- RCR -<br>RCR<br>- RCR  | 131 / 51<br>130 / 194<br>130 / 200<br>130 / 199   |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-CONCLU | 0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B  | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF<br>- RCR -<br>RCR<br>- RCR  | 131 / 51<br>130 / 194<br>130 / 204<br>130 / 195<br>130 / 195<br>130 / 195<br>130 / 195<br>130 / 195<br>130 / 32   |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-CONCLU | 0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B<br>DESCRIPTION<br>LINSTRUCTION<br>340<br>146<br>120<br>0.21  | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF - RCR - | 131 / 51<br>130 / 190<br>130 / 200<br>130 / 190<br>130 / 190<br>130 / 190<br>130 / 190<br>100 / 35<br>25 / 94   |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-CONCLU | 0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B<br>DESCRIPTION<br>LINSTRUCTION<br>360<br>146<br>120<br>0.21  | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF<br>RCR -<br>RCR<br>RCR<br>RCR<br>BLD<br>CJA<br>BLD<br>CJA<br>BLD<br>CJA<br>RCR  | 131 / 51<br>130 / 19,<br>130 / 20<br>130 / 19;<br>130 / 19;<br>47/ 91<br>82 / 32<br>108 / 35<br>25 / 94<br>130 / 18.  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-0702C SAMPLE SPECIAL ALKALINITY, TOTAL CALCIUM, BY EDTA TITRATION CHLORIDE FLUORIDE IRON, TOTAL   | DESCRIPTION 146 120 0.21 0.21 0.21 0.21 0.055   | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF<br>RCR -<br>RCR<br>RCR<br>RCR<br>RCR  | 131 / 51<br>130 / 19<br>130 / 20<br>130 / 19<br>130 / 19<br>130 / 19<br>130 / 35<br>25 / 94<br>130 / 18<br>130 / 19   |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-CONCLU | 0.005<br>0.005<br>0.0010<br>0.0028<br>0.059<br>   | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BLD<br>CJA<br>BLD<br>CJA<br>RCR   | 131 / 51<br>130 / 19,<br>130 / 20,<br>130 / 19;<br>130 / 19;<br>47 - 91<br>82 / 32<br>108 / 35<br>25 / 94<br>- 130 / 18,<br>130 / 18,   |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-CONCLU | 0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B<br>DESCRIPTION<br>LINSTRUCTION<br>360<br>146<br>120<br>0.21<br>0.21  | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF<br>RCR -<br>RCR<br>RCR<br>RCR<br>RCR  | 131 / 51<br>130 / 19<br>130 / 20<br>130 / 19<br>130 / 19<br>47 / 91<br>82 / 32<br>108 / 35<br>25 / 94<br>-130 / 18<br>130 / 19<br>130 / 18  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINC —CONCLUSION—LAB NUMBER: 8102—CONCLUSION—LAB NUMBER: 8102—ALKALINITY, TOTAL CALCIUM, BY EDTA TITRATION CHLORIDE FLUORIDE IRON, TOTAL MAGNESIUM MANGANESE NITRATE   | 0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B<br>DESCRIPTION<br>INSTRUCTION<br>360<br>146<br>120<br>0.21<br>0.21   | MG/L MG/L MG/L MG/L MG/L MG/L MG/L N: OWC-8 CHEVRON DNS: NO FREP MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L | FIELD | BLD<br>CJA<br>BLD<br>CJA<br>BLD<br>CGR<br>RCR<br>RCR<br>RCR<br>RCR<br>RCR<br>RDR  | 131 / 51<br>130 / 194<br>130 / 204<br>130 / 195<br>130 / 195<br>108 / 35<br>25 / 94<br>130 / 184<br>130 / 184<br>130 / 184<br>130 / 184<br>130 / 184  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-CONCLU | DESCRIPTION 146 120 0.21 0.21 0.21 0.21 0.21 0.21 0.21  | MG/L MG/L MG/L MG/L MG/L MG/L MG/L N: OWC-8 CHEVRON DNS: NO FREP MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L | FIELD | BTF RCR RCR RCR RCR RCR RCR RCR RCR RCR RC  | 131 / 51<br>130 / 19<br>130 / 20<br>130 / 19<br>130 / 19<br>130 / 19<br>130 / 18<br>130 / 18<br>130 / 18<br>109 / 32<br>128 / 9<br>83 / 76  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-CONCLU | 0.005<br>0.0010<br>0.0028<br>0.059<br>-0702B<br>DESCRIPTION<br>L INSTRUCTION<br>360<br>146<br>120<br>0.21<br>0.21<br>0.21<br>0.2<br>NM(0.05)<br>6.60<br>3.0 | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF<br>RCR -<br>RCR<br>RCR<br>BLD<br>CJA<br>BLD<br>CJA<br>RCR<br>RCR<br>RCR<br>CJA<br>BLD<br>CJA  | 131 / 51<br>130 / 19<br>130 / 20<br>130 / 19<br>130 / 19<br>130 / 19<br>130 / 18<br>130 / 18<br>130 / 18<br>109 / 32<br>128 / 9<br>83 / 76<br>130 / 18  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-0702C SAMPLE SPECIAL ALKALINITY, TOTAL CALCIUM, BY EDTA TITRATION CHLORIDE FLUORIDE IRON, TOTAL MAGNESIUM MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM SILICON   | DESCRIPTION 146 120 0.21 0.21 0.21 0.21 0.2 ND(0.05) 6.60 3.0   | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF RCR RCR RCR RCR RCR RCR CJA BLD CJA RCR RCR RCR RCR RCR RCR RCR RCR RCR RC  | 131 / 51<br>130 / 19,<br>130 / 20,<br>130 / 19,<br>130 / 19,<br>130 / 18,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19,<br>130 / 19, |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-CONCLU | DESCRIPTION 146 120 0.21 0.21 0.21 0.21 0.21 0.21 0.21  | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF RCR RCR RCR RCR RCR RCR RCR RCR RCR RC  | 131 / 51<br>130 / 194<br>130 / 204<br>130 / 195<br>130 / 195<br>130 / 186<br>130 / 196<br>130 / 186<br>130 / 196<br>130 / 186<br>130 / 196<br>130 / 186<br>130 / 196<br>130 / 186<br>130 / 196<br>130 / 186<br>130 / 186  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-0702C SAMPLE SPECIAL ALKALINITY, TOTAL CALCIUM, BY EDTA TITRATION CHLORIDE FLUORIDE IRON, TOTAL MAGNESIUM MANGANESE NITRATE ORTHOPHOSPHATE PH POTASSIUM SILICON SODIUM SPECIFIC CONDUCTANCE   | DESCRIPTION  360 146 120 0.21 0.21 0.2 0.605) 6.60 3.0 14 54 1350   | N: OWC-8 CHEVRON ONS: NO FREP- MG/L, AS CACO3 MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L                    | FIELD | BTF RCR RCR RCR RCR RCR RCR RCR RCR RCR RC  | 131 / 51<br>130 / 194<br>130 / 200<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194<br>130 / 194  |
| LAB NUMBER: 8102-0702B SAMPLE SPECIAL ARSENIC CADMIUM COPPER ZINCCONCLUSIONLAB NUMBER: 8102-CONCLU | DESCRIPTION  10005 0.0010 0.0028 0.059 -0702B  DESCRIPTION 146 120 0.21 0.21 0.21 0.21 0.20 0.60 3.0 14 54 1350   | MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L  | FIELD | BTF RCR RCR RCR RCR RCR RCR RCR RCR RCR RC  | 131 / 51<br>130 / 194<br>130 / 200<br>130 / 195<br>130 / 195<br>130 / 186<br>130 / 186<br>130 / 186<br>130 / 186<br>130 / 186<br>130 / 186<br>130 / 186<br>130 / 186<br>130 / 186<br>130 / 186  |

CONCENTRATION UNITS

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45,4 membrane) and acid preserved in the field.

### TABLE F-7 CHEMICAL ANALYSES

Observation Well: OWC - 8

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-26-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: 13:10

- STANDARD CHEMICAL-WATER-ANALYSIS--

- BATE: 13 MARCH 1981 - - -

LABORATORY FILE NO.: 81=9521 LABORATORY NO.: 8102-0702C SAMPLE RECEIVED 26 FEBRUARY 1981

| CATIONS          |             | * 0    |       |           | TT     | -LABORATORY<br>ANALYSIS |               |
|------------------|-------------|--------|-------|-----------|--------|-------------------------|---------------|
| CALCIUM          | CA12        | MG/L   | 1.00  |           |        | 146.00                  |               |
| IRON             | FEH2-       | 454    |       |           | /      | - 0.21                  |               |
| MAGNESIUM        | 11642       | MG/L   |       |           |        | 26.00                   |               |
| MANGANESE        | MN+2        |        |       | 00.000    |        | 0.18                    |               |
| FOTASSIUM        |             | MG/L   |       |           |        | 7 00                    |               |
| SODIUM           | NA+1        | - MG/L |       |           |        | 54.00<br>54.00          | , <u>1722</u> |
| - 22             |             |        |       |           |        |                         |               |
| ANIONS           |             |        |       |           |        |                         |               |
| BICARBONATE      | HC03-1      | MG/L   |       |           |        | 438.87                  |               |
| CARBONATE        | €03 -2      | MG/L   |       |           |        | 0+18                    |               |
| CHLORIDE         | CL -1       | MG/L   |       |           |        | 120.00                  |               |
| FLUORIDE         | F1-         | -MG/L  |       |           |        | 0.21                    |               |
| HYDROXIDE        | OH -1       | MG/L   |       |           |        | 0.00                    |               |
| NITRATE          | ND31-       | MG/L   |       |           |        |                         |               |
| FHOSPHATE        | P04 =3      | MG/L   |       |           |        | 0.00                    |               |
| SULFATE          | 504 -2-     | -41G/L |       | e me ce c | ***    | 95+00                   |               |
| SILICATE         | SI04-4      | MG/L   |       |           |        | 0.03                    |               |
| SILICA           |             |        |       | SI02      | MG/L   | 29.96                   |               |
| TOTAL FREE CARB  |             |        |       |           | MG/L   | 392+90                  |               |
| EQUILIBRIUM CAR  |             |        |       |           | MG/L   | 141.34                  |               |
| TOTAL DISSOLVED  |             | (CAL   |       | ·         |        |                         |               |
| TOTAL ALKALINIT  |             |        | AS    | CACO3     | MG/L   | 359.94                  |               |
| CALCIUM ALKALIN  |             |        |       |           |        | <del></del>             |               |
| MAGNESIUM ALKAL  |             |        |       | CACO3     | MG/L   | 0.00                    |               |
| SODIUM ALKALINI  | TY =====    |        |       |           |        | 0+00                    |               |
| TOTAL MARDNESS   | _           |        | AS    | CAC03     |        | 471.21                  |               |
| CALCIUM HARDNES  |             |        |       |           |        | - 365.00                | 71.55         |
| MAGRESIUM HARDNI |             |        |       | CACOS     |        | 106.86                  |               |
| NON-CARRONATE H  |             |        |       | 04607-    |        |                         |               |
| CALCIUM NON-CAR  |             |        |       |           | MG/L   | 5.06                    |               |
| MACRECIU: NON-C  | mistiche i. | HARRIN |       |           | MOZE   |                         |               |
| ER.              |             |        |       | UNITS     |        | 4.40                    |               |
| ERUTLIBRIUM PH   |             |        |       | UNITS     |        |                         |               |
| STABILITY INDEX  |             |        |       | UNITS     |        | 7.13                    |               |
| GATURATION SINDE |             |        |       |           |        | - 0.27                  |               |
| TEMPERATURE      |             |        |       | ENHEIT    |        | 00.85                   |               |
| COMBUCTIVITY, N  |             | 111    | GREH. | HGS/GM    |        |                         | =             |
| IDMIC STRENGTH   |             |        |       |           |        | 0.0179                  |               |
| ION BALANCE ERR  | OR (FERC    | ERT-)  | 6¥ ∈C | GHOCHTR   | MOITA: | 2+94                    |               |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

### TABLE F-8 CHEMICAL ANALYSES

Observation Well: OWC - 9

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-26-81

Time Sampled: 10:10

| ANALYSIS CONCENTRATION UNITS ANALYST BOOK/FAG  LAB NUMBER: 8102-0762A SAMPLE DESCRIFTION: OWC-9 SPECIAL INSTRUCTIONS: NO PREP  DATE SAMPLED  1045  1045  1045  1046  104  |
|---|
| SPECIAL INSTRUCTIONS: NO PREF   |
| DATE SAMPLED  |
| ALKALINITY, TOTAL CALCIUM, BY EDTA TITRATION 72 MG/L  |
| CALCIUM, BY EDTA TITRATION 72 MG/L  |
| CHLORIDE  |
| TRON. TOTAL   |
| MAGRESIUM         MG/L MG/L AS N         CJA 109 / 3           NITRATE         1.4 MG/L AS N         CJA 109 / 3           ORTHOPHOSPHATE         ND(0.05) MG/L AS P         BLD 128 / 9           PH         6.95         LKN -83 / -7           POTASSIUM         MG/L MG/L         /           SULICON         MG/L MG/L         /           SODTUM         MG/L MG/L         /           SULFATE         MG/L MG/L         /           TOTAL ORGANIC CARBGN         2.2 MG/L MG/L         GM/L          CONCLUSIONLAB NUMBER: C1C 0782A         MG/L GM/L         CJB 132 / 2           ALBRIN         0.26 UG/L GM/L         CJB 132 / 2           CHLORDANE         ND(1.0) UG/L GM/L         CJB 132 / 2           4+4-DDB         1.08 UG/L GM/L         CJB 132 / 2           4+4-DDE         0.53 UG/L GJB 132 / 2           4-4-DDE         0.53 UG/L GJB 132 / 2           4-1-DIELDRIN         0.55 UG/L GJB 132 / 2           ENDRIN         ND(0.40) UG/L GJB 132 / 2           MEPTACHLOR         ND(0.10) UG/L GJB 132 / 2           SEUIN         ND(0.10) UG/L GJB 132 / 2           SEUIN         ND(0.10) UG/L GJB 132 / 2           SEUIN         ND(0.10) UG/L GJB 132 / 2 <tr< td=""></tr<>   |
| MANGANESE   |
| NITRATE   |
| POTASSIUM SILICON SODIUM SODIUM SPECIFIC CONDUCTANCE 691 UMHOS/CM MG/L  CUBFATE TOTAL ORGANIC CARBGN CONCLUSION—LAB NUMBER: 2102 0782A  LAB NUMBER: \$102-0782B SAMFLE DESCRIPTION: OWC-9 SPECIFAL INSTRUCTIONS: FILTER GLASS FIBER  ALDRIN CHLORDANE ND(1.0) -UG/L 4.4-DDD 1.08 UG/L 4.4-DDD 1.08 UG/L 4.4-DDT 0.53 UG/L CJB 132 2 4.4-DDT 0.55 UG/L CJB 132 2 4.4-DDT 0.55 UG/L CJB 132 2 ENDRIN ND(0.40) UG/L CJB 132 2 ENDRIN ND(0.40) UG/L CJB 132 2 ENDRIN ND(0.40) UG/L CJB 132 2 CHLORDANE ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.55) UG/L |
| POTASSIUM SILICON SODIUM SODIUM SPECIFIC CONDUCTANCE 691 UMHOS/CM MG/L  CUBFATE TOTAL ORGANIC CARBGN CONCLUSION—LAB NUMBER: 2102 0782A  LAB NUMBER: \$102-0782B SAMFLE DESCRIPTION: OWC-9 SPECIFAL INSTRUCTIONS: FILTER GLASS FIBER  ALDRIN CHLORDANE ND(1.0) -UG/L 4.4-DDD 1.08 UG/L 4.4-DDD 1.08 UG/L 4.4-DDT 0.53 UG/L CJB 132 2 4.4-DDT 0.55 UG/L CJB 132 2 4.4-DDT 0.55 UG/L CJB 132 2 ENDRIN ND(0.40) UG/L CJB 132 2 ENDRIN ND(0.40) UG/L CJB 132 2 ENDRIN ND(0.40) UG/L CJB 132 2 CHLORDANE ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.10) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.20) UG/L CJB 132 2 CHLORDAN ND(0.55) UG/L |
| ### POTASSIUM   MG/L  |
| STLICON   |
| SODIUM  |
| SPECIFIC CONDUCTANCE  |
| SULFATE   |
| TOTAL DRGANIC CARBON 2.2 MG/L GMI: 05 /- 6CONCLUSIONLAB NUMBER: C10_0782A  LAB NUMBER: S102-0782B SAMFLE DESCRIPTION: OWC-9 SPECIAL INSTRUCTIONS: FILTER-GLASS-FIBER  ALDRIN 0.26 UG/L CJB 132 /- 2 4.4-DDD 1.08 UG/L CJB 132 /- 2 4.4-DDD 1.08 UG/L CJB 132 /- 2 4.4-DDT 0.53 UG/L CJB 132 /- 2 DIELDRIN 0.55 UG/L CJB 132 /- 2 ENDRIN ND(0.40) UG/L BKS 132 /- 2 ENDRIN ND(0.40) UG/L BKS 132 /- 2 MALATHION ND(0.40) UG/L CJB 132 /- 2 SEVIN NOT ANAL. UG/L CJB 132 /- 2 2.4.5-T ND(0.1) UG/L CJB 132 /- 2 2.4.5-T ND(0.1) UG/L CJB 132 /- 2 ENDRHN ND(10.0) UG/L CJB 132 /- 2 ENDRHN ND(10.0) UG/L CJB 132 /- 2 ENDRHN ND(10.0) UG/L CJB 132 /- 2 ENDRHN ND(10.0) UG/L CJB 132 /- 2 ENDRHN ND(10.0) UG/L CJB 132 /- 2 ENDRHNE ND(10.0) UG/L CJB 132 /- 2 ENDRHNE ND(10.0) UG/L CJB 132 /- 2 ENDRHNE ND(10.0) UG/L CJB 132 /- 2 ENDRHNE ND(10.0) UG/L CJB 132 /- 2 ENDRHNE ND(0.5) UG/L CJB 132 /- 2 ENDRHNEX ND(0.5) UG/L CJB 132 /- 2 ENDRHON ND(0.00) UG/L CJB 132 /- 2 ENDRHON ND(0.0       |
| LAW NUMBER: 8102-0782B SAMFLE DESCRIPTION: OWC-9 SPECIAL INSTRUCTIONS: FILTER GLASS FIBER  ALDRIN 0.26 UG/L CJB 132 / 2 CHLORDANE ND(1.0) UG/L CJB 132 / 2 4.4-DDD 1.08 UG/L CJB 132 / 2 4.4-DDE 0.22 UG/L CJB 132 / 2 4.4-DDT 0.53 UG/L CJB 132 / 2 DIELDRIN 0.55 UG/L CJB 132 / 2 DIELDRIN ND(0.40) UG/L BKS 132 / 2 HEPTACHLOR ND(0.10) UG/L CJB 132 / 2 MALATHION ND(2.0) UG/L CJB 132 / 2 2.4.5-T ND(0.1) UG/L CJB 132 / 2 2.4.5-T ND(0.1) UG/L CJB 132 / 2 DIELDRIN NOT ANAL. UG/L CJB 132 / 2 DIELDRIN NOT CANAL. UG/L CJB 132 / 2 DIELDRIN NOT CANAL. UG/L CJB 132 / 2 DIELDRIN ND(0.0) UG/L CJB  |
| LAB NUMBER: 8102-0782B SAHFLE DESCRIFTION: OWC-9 SPECIAL INSTRUCTIONS: FILTER GLASS FIBER  ALDRIN 0.26 UG/L CJB 132 / 2 4.4-DDD 1.08 UG/L CJB 132 / 2 4.4-DDD 1.08 UG/L CJB 132 / 2 4.4-DDT 0.53 UG/L CJB 132 / 2 4.4-DDT 0.53 UG/L CJB 132 / 2 DIELDRIN 0.55 UG/L CJB 132 / 2 ENDRIN ND(0.40) UG/L BKS 132 / 2 HEPTACHLOR ND(0.10) UG/L CJB 132 / 2 MALATHION ND(0.10) UG/L CJB 132 / 2 SEVIN NOT ANAL UG/L CJB 132 / 2 TOXAPHENE ND(0.1) UG/L CJB 132 / 2 TOXAPHENE ND(0.0) UG/L CJB 132 / 2 TOXAPHENE ND(10.0) UG/L CJB 132 / 2 LINDANE 0.82 UG/L CJB 132 / 2 METHOXYCHLOR ND(0.8) UG/L CJB 132 / 2 MIREX ND(0.5) UG/L CJB 132 / 2 DIFOLATAN ND(0.20) UG/L CJB 132 / 2 DIFOLATAN ND(0.50) UG/L CJB 132 / 2 DIFOLATAN ND(0.00) UG/L CJB 132 / 2 DIFOLATAN ND(0.00) UG/L CJB 132 / 2 DIFOLATAN ND(0.00) UG/L CJB 132 / 2 DIAZINON ND(0.00) UG/L CJB   |
| ALDRIN 0.26 UG/L CJB 132 / 2 CHLORDANE ND(1.0) UG/L CJB 132 / 2 4.4-DDD 1.08 UG/L CJB 132 / 2 4.4-DDE 0.22 UG/L CJB 132 / 2 4.4-DDT 0.53 UG/L CJB 132 / 2 4.4-DDT 0.55 UG/L CJB 132 / 2 DIELDRIN 0.55 UG/L CJB 132 / 2 HEPTACHLOR ND(0.40) UG/L BKS 132 / 2 MALATHION ND(0.40) UG/L CJB 132 / 2 SEVIN NOT ANAL. UG/L CJB 132 / 2 TOXAPHENE ND(0.1) UG/L CJB 132 / 2 TOXAPHENE ND(0.0) UG/L CJB 132 / 2 TOXAPHENE ND(10.0) UG/L CJB 132 / 2 TOXAPHENE ND(10.0) UG/L CJB 132 / 2 HETHOXYCHLOR ND(0.8) UG/L CJB 132 / 2 MIREX ND(0.5) UG/L CJB 132 / 2 MIREX ND(0.5) UG/L CJB 132 / 2 DIFOLATAN ND(0.20) UG/L CJB 132 / 2 DIFOLATAN ND(0.30) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIAZINON ND(0.5) UG/L CJB 132 / 2 DIAZINON ND(  |
| ALDRIN 0.26 UG/L CJB 132 / 2 CHLORDANE ND(1.0) UG/L CJB 132 / 2 4.4-DDD 1.08 UG/L CJB 132 / 2 4.4-DDE 0.22 UG/L CJB 132 / 2 4.4-DDT 0.53 UG/L CJB 132 / 2 4.4-DDT 0.55 UG/L CJB 132 / 2 DIELDRIN 0.55 UG/L CJB 132 / 2 HEPTACHLOR ND(0.40) UG/L BKS 132 / 2 MALATHION ND(0.40) UG/L CJB 132 / 2 SEVIN NOT ANAL. UG/L CJB 132 / 2 TOXAPHENE ND(0.1) UG/L CJB 132 / 2 TOXAPHENE ND(0.0) UG/L CJB 132 / 2 TOXAPHENE ND(10.0) UG/L CJB 132 / 2 TOXAPHENE ND(10.0) UG/L CJB 132 / 2 HETHOXYCHLOR ND(0.8) UG/L CJB 132 / 2 MIREX ND(0.5) UG/L CJB 132 / 2 MIREX ND(0.5) UG/L CJB 132 / 2 DIFOLATAN ND(0.20) UG/L CJB 132 / 2 DIFOLATAN ND(0.30) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIAZINON ND(0.5) UG/L CJB 132 / 2 DIAZINON ND(  |
| ALDRIN 0.26 UG/L CJB 132 / 2 CHLORDANE ND(1.0) UG/L CJB 132 / 2 4.4-DDD 1.08 UG/L CJB 132 / 2 4.4-DDE 0.22 UG/L CJB 132 / 2 4.4-DDT 0.53 UG/L CJB 132 / 2 4.4-DDT 0.55 UG/L CJB 132 / 2 DIELDRIN 0.55 UG/L CJB 132 / 2 HEPTACHLOR ND(0.40) UG/L BKS 132 / 2 MALATHION ND(0.40) UG/L CJB 132 / 2 SEVIN NOT ANAL. UG/L CJB 132 / 2 TOXAPHENE ND(0.1) UG/L CJB 132 / 2 TOXAPHENE ND(0.0) UG/L CJB 132 / 2 TOXAPHENE ND(10.0) UG/L CJB 132 / 2 TOXAPHENE ND(10.0) UG/L CJB 132 / 2 HETHOXYCHLOR ND(0.8) UG/L CJB 132 / 2 MIREX ND(0.5) UG/L CJB 132 / 2 MIREX ND(0.5) UG/L CJB 132 / 2 DIFOLATAN ND(0.20) UG/L CJB 132 / 2 DIFOLATAN ND(0.30) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIFOLATAN ND(0.0) UG/L CJB 132 / 2 DIAZINON ND(0.5) UG/L CJB 132 / 2 DIAZINON ND(  |
| CHLORDANE 4,4-DDD 1,08  |
| CHLORDANE 4,4-DDD 1,08  |
| 4,4-DDE       C.22       UG/L       CJB 132-/2         4,4-DDT       0.53       UG/L       CJB 132-/2         DIELDRIN       0.55       UG/L       CJB 132-/2         ENDRIN       ND(0.40)       UG/L       BKS 132-/2         HEPTACHLOR       ND(0.10)       UG/L       CJB 132-/2         MALATHION       ND(2.0)       UG/L       CJB 132-/2         SEVIN       NOT ANAL. UG/L       CJB 132-/2         2,4,5-T       ND(0.1)       UG/L       CJB 132-/2         YOXAPHENE       ND(10.0)       UG/L       CJB 132-/2         PCB       ND(10.0)       UG/L       CJB 132-/2         LINDANE       0.82  |
| 4.4-DDT       0.53       UG/L       CJB       132 / 2         DIELDRIN       0.55       UG/L       CJB       132 / 2         ENDRIN       ND(0.40)       UG/L       BKS       132 / 2         HEPTACHLOR       ND(0.10)       UG/L       CJB       132 / 2         MALATHION       ND(2.0)       UG/L       CJB       132 / 2         SEVIN       NOT ANAL       UG/L       CJB       132 / 2         2,4,5-T       ND(0.1)       UG/L       CJB       132 / 2         TOXAPHENE       ND(10.0)       UG/L       CJB       132 / 2         PCB       ND(10.0)       UG/L       CJB       132 / 2         METHOXYCHLOR       ND(0.8)       UG/L       CJB       132 / 2         MIREX       ND(0.8)       UG/L       CJB       132 / 2         MIREX       ND(0.5)       UG/L       CJB       132 / 2         CAPTAN       ND(0.20)       UG/L       CJB       132 / 2         DIFOLATAN       ND(0.0)       UG/L       CJB       132 / 2         CHLOROBENZILATE       ND(0.30)       UG/L       CJB       132 / 2         DIAZINON       ND(0.5)       UG/L       CJB       132 / 2  |
| DIELDRIN         0.55         UG/L         CJB         132 / 2           ENDRIN         ND(0.40)         UG/L         BKS         132 / 2           HEPTACHLOR         ND(0.10)         UG/L         CJB         132 / 2           MALATHION         ND(2.0)         UG/L         CJB         132 / 2           SEVIN         NDT ANAL         UG/L         CJB         132 / 2           2.4.5-T         ND(0.1)         UG/L         CJB         132 / 2           TOXAPHENE         ND(10.0)         UG/L         CJB         132 / 2           PCB         ND(10.0)         UG/L         CJB         132 / 2           LINDANE         0.82 - UG/L         CJB         132 / 2           METHOXYCHLOR         ND(0.8)         UG/L         CJB         132 / 2           2.4-D         ND(0.8)         UG/L         CJB         132 / 2           CAPTAN         ND(0.5)         UG/L         CJB         132 / 2           CAPTAN         ND(0.20)         UG/L         CJB         132 / 2           CHLOROBENZILATE         ND(0.30)         UG/L         CJB         132 / 2           CHLOROBENZILATE         ND(100)         UG/L         CJB         132 / 2<  |
| ND(0.40)   UG/L   BKS   132 / 2   HEFTACHLOR   ND(0.10)   UG/L   CJB   132 / 2   EMALATHION   ND(2.0)   UG/L   CJB   132 / 2   EMALATHION   ND(2.0)   UG/L   CJB   132 / 2   EMALATHION   ND(0.1)   UG/L   CJB   132 / 2   EMALATHION   ND(0.1)   UG/L   CJB   132 / 2   EMALATHION   UG/L   CJB   CMALATHION   UG/L   CJB   CMALATHION   UG/L   CJB   CMALATHION   UG/L   CJB   CMALATHION   UG/L      |
| HEPTACHLOR  |
| MALATHION         ND(2.0)         UG/L         CJB         132 / 2           SEVIN         NOT ANAL.         UG/L         CJB         132 / 2           2,4,5-T         ND(0.1)         UG/L         CJB         132 / 2           TDXAPHENE         ND(10.0)         UG/L         -CJB         132 / 2           PCB         ND(10.0)         UG/L         CJB         132 / 2           LINDANE         0.82  |
| SEVIN         NOT ANAL. UG/L         CJB - 132 / 2           2,4,5-T         ND(0.1) UG/L         CJB 132 / 2           TOXAPHENE         ND(10.0) UG/L         -CJB 132 / 2           PCB         ND(10.0) UG/L         CJB 132 / 2           LINDANE         0.82   |
| 2,4,5-T   |
| TOXAPHENE ND(10.0) UG/L CJB 132 / 2 PCB ND(10.0) UG/L CJB 132 / 2 LINDANE 0.82 UG/L CJB 132 / 2 METHOXYCHLOR ND(0.8) UG/L CJB 132 / 2 2,4-D ND(1.0) UG/L CJB 132 / 2 MIREX ND(0.5) UG/L CJB 132 / 2 CAPTAN ND(0.5) UG/L CJB 132 / 2 DIFOLATAN ND(0.20) UG/L CJB 132 / 2 CHLOROBENZILATE ND(0.30) UG/L CJB 132 / 2 DIAZINON ND(0.5) UG/L CJB 132 / 2 DIAZINON ND(0.5) UG/L CJB 132 / 2 DIAZINON ND(0.5) UG/L CJB 132 / 2   |
| ND(10.0) UG/L   |
| LINDANE 0.82 UG/L CJB 132 / 2  METHOXYCHLOR ND(0.8) UG/L CJB 132 / 2  2,4-D ND(1.0) UG/L CJB 132 / 2  MIREX ND(0.5) UG/L CJB 132 / 2  CAPTAN ND(0.20) UG/L CJB 132 / 2  DIFOLATAN ND(0.20) UG/L CJB 132 / 2  CHURDBENZILATE ND(0.30) UG/L CJB 132 / 2  GUTHION ND(100) UG/L CJB 132 / 2  DIAZINON ND(0.5) UG/L CJB 132 / 2  |
| METHOXYCHLOR         ND(0.8)         UG/L         CJB         132 / 2           2,4-D         ND(1.0)         UG/L         CJB - 132 / 2           MIREX         ND(0.5)         UG/L         CJB - 132 / 2           CAPTAN         ND(0.20)         UG/L         - CJB - 132 / 2           DIFOLATAN         ND(20)         UG/L         CJB - 132 / 2           CHLOROBENZILATE         ND(0.30)         UG/L         CJB - 132 / 2           GUTHION         ND(100)         UG/L         CJB - 132 / 2           DIAZINON         ND(0.5)         UG/L         CJB - 132 / 2   |
| 2,4-D ND(1.0) UG/L CJB - 132 / 2 MIREX ND(0.5) UG/L CJB 132 / 2 CAPTAN ND(0.20) UG/L - CJB 132 / 2 DIFOLATAN ND(20) UG/L CJB 132 / 2 CHLOROBENZILATE ND(0.30) UG/L - CJB 132 / 2 GUTHION ND(100) UG/L CJB 132 / 2 DIAZINON ND(0.5) UG/L CJB 132 / 2   |
| MIREX         ND(0.5)         UG/L         CJB         132 / 2           CAPTAN         ND(0.20)         UG/L         - CJB- 132 / 2           DIFOLATAN         ND(20)         UG/L         CJB 132 / 2           CHLOROBENZILATE         ND(0.30)         UG/L         CJB 132 / 2           GUTHION         ND(100)         UG/L         CJB 132 / 2           DIAZINON         ND(0.5)         UG/L         CJB 132 / 2   |
| CAPTAN NI(0,20) UG/L - CJB 132 / 2 DIFOLATAN ND(20) UG/L CJB 132 / 2 CHLORDBENZILATE ND(0,30) UG/L - CJB 132 / 2 GUTHION ND(100) UG/L CJB 132 / 2 DIAZINON ND(0.5) UG/L CJB 132 / 2   |
| DIFOLATAN         ND(20)         UG/L         CJB         132 / 3           CHLOROBENZILATE         ND(0.30)         UG/L         CJB         132 / 3           GUTHION         ND(100)         UG/L         CJB         132 / 3           DIAZINON         ND(0.5)         UG/L         CJB         132 / 3  |
| CHLORDBENZILATE         ND(0.30) - UG/L         CJB - 132 / 2           GUTHION         ND(100) UG/L         CJB 132 / 2           DIAZINON         ND(0.5) UG/L         CJB 132 / 2  |
| DIAZINON ND(0.5) UG/L CJB 132 / 2   |
| <del></del>   |
| PARATHION, METHYL NO. (2.0) NG/L CIR 139 / 1  |
|   |
| PARATHION, ETHYL ND(0.5) UG/L CJB 132 / 1   |
| TRITHION NOT ANAL. UG/L CJB 132 /   |
|   |
| CUNCLUSIONLAF NUMBERT 8102-07828  |
| PARATHION, ETHYL ND(0.5) UG/L CJB 1   |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45,4 membrane) and acid preserved in the field.

### TABLE F-8 CHEMICAL ANALYSES

Observation Well: OWC - 9

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-26-81

Time Sampled: \_\_\_10:10

#### STANDARD CHEMICAL WATER ANALYSIS.

DATE: 03/13/81

LABORATORY FILE NO.: 81-9521 LABORATORY NO.: 8102-0782A -SAMFLE RECEIVED 02/27/81

|              | 222              |           |            | (4)       |       | LABORATORY | 6                  |
|--------------|------------------|-----------|------------|-----------|-------|------------|--------------------|
|              | CATIONS          |           |            |           |       | ANALYSIS   |                    |
|              | CALCIUM          | CA+2      | MG/L       |           |       | 72.00      |                    |
|              | IRON             | FEI2 -    | 116/L - == |           |       | 0.00       |                    |
| 555 W. C. C. | MAGNESIUM        | MG+2      | MG/L       |           | -     | 20.90      |                    |
|              | MANGANESE        | MN12      | MG/L =     |           |       | 20.90      |                    |
| 74 274 87    | FOTASSIUM        | K +1      | MG/L       |           |       |            | 15- 110            |
|              | SODIUM           | NA+1      |            |           |       | 1.10       |                    |
|              | SUPTUR           | NATI      | MG/L -     |           |       | - 35.00-   |                    |
|              | 3 11 11 114      |           |            |           |       |            |                    |
|              | ANIONS           |           |            |           |       |            |                    |
| N. F. Marco  |                  | ,4. W     | 20.5       | F2FV-F    |       |            | 1100 - 1000 - 1000 |
|              | BICARBONATE      | HC03-1    | MG/L       |           |       | 365.46     |                    |
| 0.000        | CARBONATE        | CO3 -2    | MG/L       | 3 0 20 20 |       | 0.27       | a someone          |
|              | CHLORIDE         | CL -1     | MG/L       |           |       | 7.00       |                    |
|              | FLUORIDE -       | F = 1     | MG/L       |           |       | 0.52       |                    |
|              | HYDROXIDE        | OH -1     | MG/L       |           |       | 0.00       |                    |
|              | NITRATE          | NO3 -1    | MG/L       |           |       | 6.20       |                    |
|              | PHOSPHATE        | PO4 -3    | MG/L       |           |       | 0.00       |                    |
|              | SULFATE          | SO4 -2    | MG/L =     |           |       | 35.00      | 102 1 20 100       |
|              | SILICATE         | SI04-4    | MG/L       |           |       | 0.03       |                    |
|              |                  | M M       |            |           |       |            |                    |
|              | SILICA           |           |            | SI02      | MG/L  |            |                    |
|              | TOTAL FREE CARB  |           |            | 002       | MG/L  |            |                    |
|              | EQUILIBRIUM CAR  |           |            | 002       | MG/L  | 52.86      |                    |
| 8            | TOTAL DISSOLVED  |           |            | WT 3.     | MC/L  |            |                    |
|              | TOTAL ALKALINIT  | -         | AS         | CACO3     | MG/L  | 299.95     |                    |
|              | CALCIUM ALKALIN  |           | AS         |           | -MG/L | 180+00     |                    |
|              | MAGNESIUM ALKAL  | INITY     | AS         | CACO3     | MG/L  | 85.90      |                    |
|              | SODIUM ALKALINI  | TY        | AS         | CACO3     | MG/L  | 34.35      | 500 MG 8 H         |
|              | TOTAL HARDNESS   |           | AS         | CACO3     | MG/L  | 265.60     |                    |
|              | CALCIUM HARDNES  | S         | AS         | CACO3     | MG/L  | 180.00     | 0.00               |
|              | MAGNESIUM HARDN  | CSS       | AS         | CACO3     | MG/L  | 85.90      |                    |
|              | NON-CARBONATE H  | ARDNESS   | AS         | - CACO3   | MG/L  | 0.00-      |                    |
|              | CALCIUM NON-CAR  | BONATE II | ARDNESS    |           | MG/L  | 0.00       |                    |
|              | MAGNESIUM NON C  | REBUNATE  | HARDNESS   |           | MG/L  | 0.00       |                    |
|              | ₽Ή               |           | F11        | UNITS     |       | 6.95       |                    |
|              | EQUILIBRIUM PH   | (PHS)     | FH         | UNITS     |       | 7.23       |                    |
|              | STABILITY INDEX  |           | FH         | UNITS     |       | 7.50       |                    |
| - 1 844 10   | SATURATION INDE  | X         | - FH       | UNITS.    |       | 0.28       |                    |
|              | TEMPERATURE      |           | EES FAHR   |           |       | 68.00      |                    |
|              | CONDUCTIVITY, 13 |           |            | HOS/CM    |       | 691.00     |                    |
|              | IONIC STRENGTH   |           |            |           |       | 0.0100     | - 127              |
|              | ION DALANCE ERR  |           | ENT) BY O  | ONCENTA   | ATTON | =1.21      |                    |
|              |                  |           | M. C       |           | 2017  |            |                    |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

#### TABLE F-12 CHEMICAL ANALYSES

Observation Well: OWC - 13

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-25-81

Time Sampled: 13:00

#### STANDARD CHEMICAL WATER ANALYSIS --

DATE: 03/12/81

LARGRATORY FILE NO.: -81-9521 -LABORATORY NO.: 8102-0784E -SAMPLE RECEIVED 02/27/81

|                  | CATIONS            | 7-               | 10-10-7 No. 10-10-8 | a — ia — iii |           | ABORATORY | - m (1101 — 111 |
|------------------|--------------------|------------------|---------------------|--------------|-----------|-----------|-----------------|
| mend Section     | CALCIUM            | CA+2             | MG/L                | 1.0.0        | -         | 232.00    |                 |
|                  |                    | E+2              | -MC-/1              |              |           |           |                 |
|                  |                    | 1G+2             | MG/L                |              |           | 42.90     |                 |
|                  |                    | 1N+2             | MG/L                |              |           | 1.30      |                 |
|                  |                    | ( +1             | MG/L                |              | 12 (8) 0  | 1.20      |                 |
| 142 141 153      |                    |                  | MG/L                | 7.52         | 20 52 525 | 52.00     | S/ 6_ W89_      |
|                  | ,                  |                  |                     |              |           | 42.700    |                 |
|                  | ANIONS             |                  |                     | 11           |           |           |                 |
| 1.60             | DICADDONATE I      | 1007 1           | MC (I               |              |           | 210 50    |                 |
|                  |                    | HC03-1<br>C03 ≔2 | MG/L<br>MG/L        |              |           | 219.50    |                 |
| and the title to |                    | DL -1            | MG/L                |              | -         | 232.00    |                 |
|                  |                    |                  | _MG/L               |              |           | 0.14      |                 |
|                  |                    | DH ~1            | MG/L                |              |           | 0.00      |                 |
|                  |                    | NO3 -1           |                     | 1527         |           | 0.00      |                 |
|                  |                    | PO4 -3           | MG/L                |              |           | 0.00      |                 |
|                  |                    | 504 -2           | MG/L                |              |           | 200+00    |                 |
|                  |                    | 5104-4           | MG/L                |              |           | 0.01      |                 |
|                  |                    | 3104 4           | 1107 L              |              |           | 0.01      |                 |
|                  | SILICA             |                  |                     | SI02         | MG/L      | 23.54     |                 |
| 155.T 155.5      | TOTAL FREE CARBO   | N DIOXI          | DE                  | C02          | MG/L ===  | 367.19    |                 |
|                  | EQUILIBRIUM CARB   | N DIOX           | IDE                 | C02          | MG/L      | 53.14     |                 |
|                  | TOTAL DISSOLVED    | SOLIDS           | (CALC)              | - 100        | MG/L      | 1001-06 - |                 |
|                  | TOTAL ALKALINITY   |                  | AS                  | CACO3        | MG/L      | 179.96    | ,               |
|                  | CALCIUM ALKALINI   | T.Y              |                     | -CAC03 -     | MG/L      | 179.96    |                 |
|                  | MAGNESIUM ALKALI   | NITY             | AS                  | CACO3        | MG/L      | 0.00      |                 |
| 1941             | SODIUM ALKALINIT   | Υ                | . AS                | CACO3        | MG/L      | 0.00      | - 191 -         |
|                  | TOTAL HARDNESS     |                  | AS                  | CACO3        | MG/L      | 755.29    |                 |
|                  | CALCIUM HARDNESS   |                  | - AS                | CACO3        | HG/L      | 580.00    | # PE B P        |
|                  | MAGNESIUM HARDNE   | SS               | AS                  | CACO3        | MG/L      | 176.32    |                 |
| 4.4.4.40.00      | NON-CARBONATE HAI  | RIMESS -         | _ A5                | CACO3 -      | MG/L      | 575.33    | <del></del>     |
|                  | CALCIUM NON-CARI   | ONATE H          | ARDNESS             |              | MG/L      | 400.04    |                 |
|                  | MAGNESIUM NON-CA   | RBONATE          | HARDNESS            |              | MG/L      | 176.32    | Em 50 50%       |
|                  | PH                 |                  | PH                  | UNITS        |           | 6.35      |                 |
|                  | - EQUILIBRIUM FH ( | PHS)             | PH                  | UNITS        |           | 4.98      |                 |
|                  | STABILITY INDEX    |                  | PH                  | UNITS        |           | 7.61      |                 |
| FE 155           | SATURATION INDEX   |                  | PH-                 | UNITS        |           | 54.0==    |                 |
|                  | TEMPERATURE        | DEGR             |                     | ENHEIT       |           | 68.00     |                 |
|                  | CONDUCTIVITY, ME   | ASURED           | MICROM              | HOS/CM       |           | 1560.00   |                 |
|                  | IONIC STRENGTH (   |                  |                     |              |           | 0.0255    |                 |
|                  | ION BALANCE ERRO   | R (PERC          | ENT) ACTI           | VITY CO      | RRECTED : | -1.28     |                 |
|                  |                    |                  |                     |              |           |           |                 |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

# TABLE F-13 CHEMICAL ANALYSES

Observation Well: OWC - 14

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-25-81

Time Sampled: 15:30

| ANALYSIS                | CONCENTRATION                             | UNITS                          | ANALYST BOOK/PAG                |
|-------------------------|---|--------------------------------|---------------------------------|
| LAB NUMBER: 8102-0785A  | SAMPLE DESCRIPTION                        | 1: DWC-14                      | 88                              |
|                         | SFECIAL INSTRUCTIO                        | NS: NO FREP                    |                                 |
| DATE SAMPLED            | 0 (05 (04                                 |                                | (d) (E)                         |
| TIME SAMPLED            | 2/25/81                                   |                                | · ·                             |
| ALKALINITY, TOTAL       | 1530                                      | MC /I AC CACOT                 | - 1 Table - 1                   |
| CALCIUM, BY EDTA TITRAT | ION 104                                   | MG/L, AS CACO3                 | 214 22 4 7                      |
| CHLORIDE                | 74  | MG/L<br>MG/L                   | CJA 82 / 3                      |
| FLUORIDE                |   | MG/L                           | PLD 108 / 3                     |
| IRON, TOTAL             | V+103                                     | MG/L                           | CJA 25 / 9                      |
| MAGNESIUM               |   | MG/L                           | - /- /- n                       |
| MANGANESE               |   | MG/L                           |                                 |
| NITRATE                 | 1.0                                       | MD/L AS N                      | CJA 109 / 3                     |
| ORTHOPHOSPHATE          | 0.10                                      | MG/L AS F                      | BLD 128 / 5                     |
| PH                      | 6.85                                      | HOZE HS I                      | LKN 63 / 7                      |
| POTASSIUM               | 0.03                                      | MG/L                           | LIN 63 / /                      |
| SILICON                 | _   | MG/L -                         | a contea or de le manuel de les |
| SODIUM                  | -   | MG/L                           |                                 |
| SPECIFIC CONDUCTANCE    | 1050                                      | -                              |                                 |
| CHI EATE                |   | UMHOS/CM<br>MG/L               | MJB 124 / :                     |
| TOTAL ORGANIC CARBON    | 5.6                                       | MG/L - :                       | CMD DE                          |
| CONCLUSIONLAB NUMBE     | R: 8102-07854                             | no/L                           | GMD 85 / (                      |
|                         |   |                                |                                 |
|                         | 100000000 FE                              | . 6 =                          | 10 0 0 L                        |
| LAS MUNISSA GAGO COST   |   |                                |                                 |
| LAB NUMBER: 8102-0795B  | SAMPLE DESCRIPTION                        | N; OWC-14                      |                                 |
|                         | SFECIAL INSTRUCTIO                        | JNS: FILIER GLASS              | FIBER                           |
| ALDRIN                  | 0.88                                      | UG/L                           | CJB 132 / 2                     |
| CHLORDANE               | ND(1.0)                                   | UG/L                           | CJB - 132 / :                   |
| 4,4-1010                | .50                                       | 110.41                         |                                 |
| 4+4-DDE                 | ND(0.20)-                                 | LIC /I                         |                                 |
| 4 • 4 - DDT             | NI(0.30)                                  | UG/L                           | CJB 132 / /                     |
| DIELDRIN                | 0.69                                      | UG/L                           | CJB - 132 -/                    |
| ENDRIN                  | NI(0.40)                                  | UG/L                           | BKS 132 / 2                     |
| HEPTACHLOR              |   | UG/L                           | = - C.IB132 /-                  |
| MALATHION               | ND(2.0)                                   | UG/L                           | CJB 132 / :                     |
| SEVIN                   | - NOT ANAL-                               |                                |                                 |
| 2,4,5-T                 | ND(0.1)                                   | UG/L                           | CJB 132 /                       |
| TOXAPHENE               | ND(10.0)                                  | -UG/L -                        | CJB 132 /                       |
| PCB                     |   |                                | CJR 132 / 1                     |
| LINDANE                 | ND(10.0)<br>0.93<br>ND(0.8)               | UG/L                           | **- CJR 132 / 3                 |
| METHOXYCHLOR            | NI(0.8)                                   | UG/L                           | CJB 132 /                       |
| 2 · 4-D                 | ND(1.0)                                   | UG/L -                         | ®CJB132- ≠ 4                    |
| MIREX                   | MT(0*2)                                   | U6/L                           | CJR 132 / 3                     |
| CAPTAN                  | ND(0.20)                                  | UG/L                           | CJE . 132 /                     |
| DIFOLATAN               | ND(20)                                    | UG/L                           | CJR 132 / 1                     |
| CHLOROBENZILATE         |   | UG/L                           | ⊕ CJB - = 132 / 2               |
| GUTHION                 | ND(0.30)                                  | UG/L                           | CJB 132 / 1                     |
| DIAZINON                | ND(0.5)                                   | -UG/L 🖂 😸 -                    |                                 |
| PARATHION, METHYL       | ND(2.0)                                   | UGZL                           | CJR 132 / 2                     |
| PARATHION, ETHYL        | NI(0.5)                                   | UG/L                           | CJE = 432 / 3                   |
| TRITHION                | NOT ANAL.                                 |                                | CJB 132 / 2                     |
| PHOSDRIN (MEVINPHOS)    |   | UG/L                           | CJB - = 132 / 2                 |
| CONCLUSIONLAB NUMBE     |   |                                | OUD SIGE / I                    |
|                         |   |                                |                                 |
| LAB NUMBER: 8102-07850  | SAMPLE DESCRIPTION<br>SPECIAL INSTRUCTION | : OWC-14<br>DNS: FILTERED IN F | IELD                            |
| AGCENTO                 |   |                                |                                 |
| ARSENIC<br>CAUMIUM      | 0.008                                     | MG/L                           | BTF- 🕾 131 / 8                  |
| GREETLUS                | 0.0018                                    | MG/L                           | BTF 131 / 5                     |
|                         |   |                                |                                 |
| COPPER<br>ZINC          | 0.020<br>0.08                             | MG/L<br>MG/L                   | BTF 0 1-31 /- 5<br>BTF 131 / 5  |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

# TABLE F-13 CHEMICAL ANALYSES

Observation Well: OWC - 14

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-25-81

Time Sampled: 15:30

#### STANDARD CHEMICAL WATER ANALYSIS

DATE: 03/13/81

LABORATORY FILE NO.: 81-9521 LABORATORY NO.: 8102-0785A —SAMPLE\_RECEIVED 02/27/81

| • | CATIONS         |             |           |         |        | LABORATORY | Y |
|---|-----------------|-------------|-----------|---------|--------|------------|---|
|   | :               | -           | -         |         |        |            |   |
|   | CALCIUM         | CA+2        | MG/L      |         |        | 104.00     |   |
|   | IRON            | -FE+2       | -MG/L     |         |        |            |   |
|   | MAGNESIUM       | MG+2        | MG/L      |         |        | 25.10      |   |
|   | MANGANESE       | MN+2        | MG/L      |         |        | 0.00 -     |   |
|   | FOTASSIUM       | K +1        | MG/L      |         |        | 2.10       |   |
| - | SODIUM          | NA+1        | MG/L      |         |        | -58.00     |   |
|   | ANIONS          | - · · · · - |           |         |        |            |   |
|   | BICARBONATE     | HC03-1      | MG/L      |         |        | 365.48     |   |
|   | CARBONATE       | CO3 -2      | MG/L      |         |        | . 0.25 -   |   |
|   | CHLORIDE        | CL -1       | MG/L      |         | •      | 74.00      |   |
|   |                 | -F=1        |           |         |        | 0.17       |   |
|   | HYDROXIDE       | OH -1       | MG/L      |         |        | 0.00       |   |
|   | NITRATE         | NO3 -1      | MG/L      |         |        | 4.43       |   |
|   | PHOSPHATE       | P04 -3      | MG/L      |         |        | 0.31       |   |
|   | SULFATE         | SO4 -2      | MG/L      |         |        | 100.00     |   |
|   | SILICATE        | SI04-4      | MG/L      |         |        | 0.04       |   |
|   | SILICA          |             |           | SI02    | MG/L   | 27.82      |   |
|   | TOTAL FREE CARB | מא הדמצוו   | DE        | 0102    | MG/L   |            |   |
|   | EQUILIBRIUM CAR |             |           | CO2     | MG/L   | 72.00      |   |
|   | TOTAL DISSOLVED |             |           |         |        |            |   |
|   | TOTAL ALKALINIT |             | AS        | CACO3   | MG/L   | 299.92     |   |
|   | CALCIUM ALKALIN |             | AS.       |         | MG/L   |            |   |
|   | MAGNESIUM ALKAL |             | AS        | CACO3   | MG/L   | 39.92      |   |
|   | SODIUM ALKALINI | TY          | AS        | CACO3   | MG/L   | 0.00       |   |
|   | TOTAL HARDNESS  |             | AS        | CACO3   | MG/L   | 362.72     |   |
|   | CALCIUM HARDNES | S           | AS        | CACO3   | MG/L   | 260.00     |   |
|   | MAGNESIUM HARDN | ESS         | AS        | CAC03   | MG/L   | 103.16     |   |
|   | NON-CARDONATE H | ARDNESS     | AS        | CAC03   | MG/L . | 62+80      | · |
|   | CALCIUM NON-CAR | BONATE H    | ARINESS   |         | MG/L   | 0.00       |   |
|   | MAGNESIUM NON-C | ARBONATE    | HARDNESS  | 3       | MG/L   | 63.24      |   |
|   | PH              |             | PH        | UNITS   |        | 6.85       |   |
|   | EQUILIBRIUM PH  | (PHS)       | F'H       | STINU   |        | . 7.08     |   |
|   | STABILITY INDEX |             | PH        | UNITS   |        | 7.32       |   |
|   | SATURATION INDE |             |           | _UNITS  |        | 0.23_      |   |
|   | TEMF ERATURE    | DEGRI       |           | CNHEIT  |        | 68.00      |   |
|   | COMDUCTIVITY, M |             | MICRON    | HCS/CM  |        | 1050.00    |   |
|   | IONIC STRENGTH  |             |           |         |        | 0.0147     |   |
|   | ION EALANCE ERR | OR (PERC    | ENT) BY ( | ONCENTR | MOITA: | -2.11      |   |

<sup>\*</sup> Groundwater samples for metals analysis were filtered  $(0.45 \mu)$  membrane and acid preserved in the field.

### TABLE F-14 CHEMICAL ANALYSES

Observation Well: OWC - 15

Ortho Chevron Chemical Company Plant

Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-25-81

Time Sampled: 14:45

| ANALYSIS                              | CONCENTRATION  | UNITS                              | ANALYST BOOK/PA   |
|---------------------------------------|--|------------------------------------|-------------------|
| LAB NUMBER: 8102-0786A SAMPL<br>SPEC: | IAL INSTRUCTI  |                                    | 1960 (2012) 12121 |
| DATE SAMPLED                          | 2/25/81  | in a final section of              | /                 |
| TIME SAMPLED                          | 1445   |                                    | 100 BB 6 1 - 18   |
| ALKALINITY, TOTAL                     |  | MG/L, AS CACO3                     | /                 |
| CALCIUM, BY EDTA TITRATION            | 39   | MG/L -                             | CJA -82 / 3       |
| CHLORIDE                              | 28.5   | MG/L                               | RLD 108 / 3       |
| FLUORIDE                              |  | MG/L                               | CJA               |
| IRON, TOTAL                           |  | MG/L                               | /                 |
| MAGNESIUM                             |  | MG/L                               | /                 |
| MANGANESE                             |  | MG/L                               | /                 |
| NITRATE                               | 1.9  | MG/L AS N                          | CJA 109 / 3       |
| ORTHOPHOSPHATE                        | 0.07   | MG/L AS P                          | BLD 128 / 1       |
| PH                                    | 6.60   | -                                  | EKN -83 -/-1      |
| POTAGSIUM                             |  | MG/L                               | /                 |
| SILICON                               |  | MG/L                               | /                 |
| SODIUM                                |  | MG/L                               | /                 |
| SPECIFIC CONDUCTANCE                  | 411  | UMHOS/CM                           | MJB 124 /         |
| SULFATE                               |  | MG/L                               | /                 |
| TOTAL ORGANIC CARBON                  | 1.7  | HS/L                               | GMD85 Z -         |
| CONCLUSION LAB NUMBER: S1             | 01-0786A   |                                    |                   |
|                                       |  |                                    |                   |
|                                       |  |                                    |                   |
| LAB NUMBER: 8102-0786B SAMP           | LE DESCRIPTIO  | N: OWC-15                          |                   |
| SPEC                                  | IAL INSTRUCTI  | ONS: FILTER GLASS F                | FIBER - H H       |
| ALDRIN                                | NE(0.12)   | UG/L                               | CJB 132 /         |
| CHLORDANE                             | ND(1.0)  | - UG/L - =                         | GJB132≠           |
| 4,4-DDD                               | ND(0.20)   | UG/L                               | CJB 132 /         |
| 4,4-DDE                               | ND(0.20)   | UG/L                               | CJB 132 ✓         |
| 4,4-DDT                               | ND(0.30)   | UG/L                               | CJB 132 /         |
| DIELDRIN                              | 0.21   | UG/L                               | CJB - 132 /       |
| ENDRIN                                | NI(0.40)   | UG/L                               | BKS 132 /         |
| HEFTACHLOR                            | ND(0.10) -   | - UG/L                             | CJF132 ←          |
| MALATHION                             | ND(2.0)  | UG/L                               | CJB 132 /         |
| SEVIN                                 | NOT ANAL.  | UG/L                               | UF 132 /-         |
| 2,4,5-T                               | ND(0.1)  | UG/L                               | CJB 132 /         |
| TOXAFHENE                             | ND(10.0)   | UG/L =                             | CJB = 132 ✓       |
| PCB                                   | ND(10.0)   | UG/L                               | CJB 132 /         |
| LINDANE                               | - 0.23 -   | — UG/L                             | - CJB             |
| METHOXYCHLOR                          | ND(0.8)  | UG/L                               | CJB 132 /         |
| 2 · 4-D                               | ND(1.0)  | UG/L -                             | - CJB 132 ✓       |
| MIREX                                 | ND(0.5)  | UG/L                               | CJB 132 /         |
| CAPTAN                                | ND(0.20)   | UG/L =====                         | CJB -132 / -      |
| DIFOLATAN                             | NII(20)  | UG/L                               | CJB 132 /         |
| CHLOROBENZILATE                       | . ND(0.30)   | ≲: UG/L - ≈ - ::                   | CJB132/-          |
| GUTHION                               | ND(100)  | UG/L                               | CJB 132 /         |
| DIAZINON                              | ND(0.5)  | UG/L                               | CJB 432-√         |
| FARATHION, METHYL                     | ND(2.0)  | UG/L                               | CJB 132 /         |
| PARATHION, ETHYL                      | ND(0.5)  | UG/L                               | CJB = 132 /       |
| TRITHION                              | NOT ANAL.  | UG/L                               | CJB 132 /         |
| PHOSDRIN (MEVINPHOS)                  | ND(2.0)  | UG/L -                             | CJB132≠-          |
| CONCLUSIONLAR NUMBER: 81              | 02-0786B   |                                    |                   |
|                                       |  |                                    |                   |
|                                       |  |                                    |                   |
|                                       | LE DESCRIPTION PROPERTY OF THE | )N: OWC-15<br>(GNS: FILTERED TH EX | TELD              |
|                                       |  |                                    |                   |
| ARSENIC                               | ND(0.001)  |                                    | BIF 131 /         |
|                                       | ND(0.000   | i) MG/L                            | PTF 131 /         |
| CADMIUM                               |  |                                    |                   |
| COFFER                                | 0.0020   | MG/L                               | BTF 431 /         |
|                                       | 0.0020<br>0.03   | MG/L<br>MG/L                       | BTF 131 /         |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45 $\mu$  membrane) and acid preserved in the field.

#### TABLE F-14 CHEMICAL ANALYSES

Observation Well: OWC - 15

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories Salina, Kansas

File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled:

2-25-81

Time Sampled: 14:45

STANDARD CHEMICAL WATER ANALYSIS -

DATE: 03/12/81

LABORATORY FILE NO.: 81-9521 -LABORATORY NO.: 8102-0786A SAMPLE RECEIVED 02/27/81

| 35 3 F       | CATIONS                                       |  |              | LABORATORY.<br>ANALYSIS    | = 1000 (*)            |
|--------------|---|--|--------------|----------------------------|-----------------------|
| 140          | 19.   |  |              | 3601.04                    | V (10) (10) (10) (10) |
|              | CALCIUM CA+2                                  | MG/L                                   |              | 39.00                      |                       |
|              | IRON FE+2                                     | -MG/L                                  |              | 0.09                       |                       |
|              | MAGNESIUM MG+2                                | MG/L                                   |              | 12.40                      |                       |
| 40.00        | MANGANESE MN+2                                | MG/L 1500 S                            |              | 0.07                       |                       |
|              | POTASSIUM K +1                                | MG/L                                   |              | 0.70                       |                       |
| 04 3 3       | SODIUM NA+1                                   | MG/L                                   |              | 12.00                      | /                     |
|              | ANIONS  |  |              |                            |                       |
|              |   | 9 N 199                                |              |                            |                       |
|              | BICARBONATE HC03-1                            | MG/L                                   |              | 79.21                      |                       |
| 122221 12 2  | CARBONATE - CO3 -2                            | MG/L                                   |              | 0.02                       |                       |
|              | CHLORIDE CL -1                                | MG/L                                   |              | 28.50                      |                       |
|              | FLUORIDE F                                    | MG/L                                   |              | 0.14                       |                       |
|              | HYDROXIDE OH -1                               | MG/L                                   |              | 0.00                       |                       |
| W-945 - 1991 | NITRATE N03 -1                                | MG/L ==                                |              | 8.42                       |                       |
|              | PHOSPHATE PO4 -3                              | MG/L                                   |              | 0.21                       |                       |
|              | SULFATE S04 -2                                | MG/L -                                 |              | 60.00                      |                       |
|              | SILICATE SIO4-4                               | MG/L                                   |              | 0.03                       |                       |
|              | SILICA  | SI02                                   | MG/L         | 34.24                      |                       |
|              | TOTAL FREE CARBON DIOX                        |  | MG/L         | 62.94                      | •                     |
|              |   |  |              |                            |                       |
|              | EQUILIBRIUM CARBON DIO TOTAL DISSOLVED SOLIDS |  | MG/L         | 1.44                       |                       |
| ***          |   |  | MG/L<br>MG/L | 273.74                     |                       |
|              | TOTAL ALKALINITY                              | AS CACO3                               |              | 64.94                      |                       |
|              | CALCIUM ALKALINITY                            | ************************************** | MG/L -       | -44+94                     |                       |
|              | MAGNESIUM ALKALINITY                          | AS CACO3<br>AS CACO3                   | MG/L         | 0.00                       |                       |
|              | SODIUM ALKALINITY                             |  |              |                            |                       |
|              | TOTAL HARDNESS                                | AS CACO3                               | MG/L         | 148.31                     |                       |
|              | CALCIUM HARINESS                              | AS CACO3                               | MG/L<br>MG/L | 97.50                      | 35 1355               |
|              | MAGNESIUM HARDNESS                            | AS CACO3                               |              | 50.96<br>== 23.37          |                       |
| See:         | NON-CARDONATE HARDNESS                        |  |              |                            |                       |
|              | CALCIUM NON-CARBONATE                         |  | MG/L         | 32.56                      |                       |
|              | MAGNESIUM NON-CARBONAT                        |  | MG/L         | 50.94                      |                       |
|              | FH FOUT TESTUM OF TENS                        | PH UNITS<br>PH UNITS                   |              | 6.60<br>8.13               |                       |
|              | EQUILIBRIUM FH (FHS)                          | PH UNITS                               |              | 7.66                       |                       |
|              | STABILITY INDEX                               | FH UNITS                               |              | 7+00<br>-1 <sub>4</sub> 53 |                       |
|              |   | RCES FAHRENHEIT                        |              | 68.00                      |                       |
|              |   |  |              |                            |                       |
|              | CONDUCTIVITY, MEASURED                        |  |              | 411.00                     |                       |
|              | IONIC STRENGTH (MOLAR)                        |  |              | 0.0056                     |                       |
|              | ION BALANCE ERROR (PER                        | CENT) BY CONCENT                       | MULLEY       | 0.13                       |                       |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

#### APPENDIX G

DISCUSSION OF LABORATORY ANALYSES
AND METHODOLOGY

528 NORTH NINTH • SALINA, KANSAS 67401 • LAB: (913) 825-7186 OFFICE: (913) 827-0433

13 March 1981

Dr. J. D. Campbell Woodward-Clyde Consultants 5055 Antioch Road Overland Park, KS 66203

Re: Wilson Laboratories File No. 81-9521

Dear Dr. Campbell:

Enclosed are the results of the analyses of the Chevron soil and water samples. The organic analyses were performed in accordance with EPA procedures published in the <u>Federal Register</u>, Volume 38, No. 75, Pt. II.; all other analyses were performed in accordance with EPA procedures published in the <u>Federal Register</u>, Volume 44, No. 233, Monday, 23 December 1979, pages 69568 through 69573. Samples for heavy metals analyses were filtered in the field through a 0.45 micron filter. Samples for organic analyses were filtered through a glass fiber filter of approximately 1 micron pore size prior to analyses.

Analyses for Kelthane, Sevin and Trithion have not been performed.

Kelthane did not elute properly from the gas chromatograph and could not be analyzed in the samples.

It was anticipated that Sevin could be analyzed with the organophosphorus pesticides on the nitrogen/phosphorus gas chromatograph detector. However, analyses of the samples indicated that interferences were present, which precluded use of the nitrogen/phosphorus detector for the organophosphorus compounds. The samples were then analyzed with the highly selective flame photometric detector operated in the phosphorus mode. Using this mode of operation, six phosphorus containing compounds were analyzed but Sevin could not be detected because the detector is not sensitive to nitrogen containing compounds.

A standard has been ordered for Trithion but has not been received. The extracts can be re-analyzed for Trithion upon receipt of the standard, however, no unidentified peaks were observed in the analyses of the organophosphorus pesticides indicating that Trithion was not present.

Lindane and Aldrin results on sample OWC-13 were confirmed by analyses of the extract by capillary gas chromatography with Hall electrolytic conductivity detection operated in the halogen mode.

13 March 1981 Dr. J. D. Campbell Page 2

The most frequently observed pesticide was Lindane, the gamma isomer of hexachlorocyclohexane. In samples OWC-7 and OWC-13 the concentration was approximately 2 mg/1. The Handbook of Environmental Data on Organic Chemicals by Karl Verschaeren published by Van Nostrand and Reinholt in 1977 states that the water solubility of Lindane is 10 mg/1.

The drinking water limits for parameters of interest are tabulated below:

| Arsenic      | 0.05  mg/1                    |
|--------------|-------------------------------|
| Cadmium      | 0.010 mg/1                    |
| Copper       | 1.0 mg/l (Secondary Standard) |
| Zinc         | 5.0 mg/l (Secondary Standard) |
| Endrin       | 0.2 ug/1                      |
| Lindane      | 4.0 ug/l                      |
| Methoxychlor | 100 ug/l                      |
| Toxaphene    | 5.0 ug/1                      |
| 2,4-D        | 100 ug/1                      |

Gas chromatography/mass spectrophotometry analyses can be performed on a highly contaminated sample to confirm the identifications of this preliminary analysis and to obtain qualitative identification of unidentified peaks. An alternative procedure to GC/MS analysis is proposed for confirmation of the organochlorine pesticides and herbicides. This procedure involves further concentration of the extracts, followed by analysis utilizing a different gas chromatograph column and detection system. This procedure is preferable to GC/MS analysis for two reasons.

- 1) Approximately 4 weeks would be required for GC/MS analysis at a cost of approximately \$500 per sample.
- 2) In our recent conversation with the GC/MS lab we encountered reluctance to perform any special preparations, or analysis for compounds other than those Priority Pollutants routinely analyzed.

Since we are interested in specific types of compounds, the class - specific GC analyses will be of better use and will provide the information we need. The GC/MS lab does not perform GC/MS scans for herbicide compounds, since these are not classed as Priority Pollutants.

This proposed re-analysis procedure would be performed by Wilson Laboratories using extracts already prepared and would require less than two weeks at a cost of \$150 per sample. Identified Priority Pollutants will be confirmed. Unidentified peaks of significance would be tentatively identified by published GC retention data followed by analyses of the actual compound under identical conditions as the samples.

A write-up of procedures, methodology and experimental retionale will be provided to you for use in your report with the confirmatory analyses reports.

WILSON LABORATORIES

Clifford of Bohln
Clifford J. Baker

Chemist



528 NORTH NINTH • SALINA, KANSAS 67401 • LAB: (913) 825-7186 OFFICE: (913) 827-0433

26 March 1981

Woodward-Clyde Consultants Attn: Dr. J. D. Campbell 5055 Antioch Road Overland Park, KS 66203

Re: Wilson Laboratories File No. 81-9521

Dear Dr. Campbell:

Wilson Laboratories has completed confirmatory analyses of selected Chevron samples for pesticides and herbicides. The analytical procedures and rationale for the procedures is discussed below.

## Organochlorine Pesticides Analyses

The samples were analyzed in accordance with EPA Method 608, Organochlorine Pesticides and PCB's published in the <u>Federal Register</u>, Volume 44, No. 233, Monday, 23 December 1979. This procedure involves successive extractions of 1 liter of sample at neutral pH, with dichloromethane followed by concentration of the dichloromethane, solvent exchange to hexane and re-concentration to a final volume of 10 ml. The hexane extract is then analyzed by packed column gas chromatography with electron capture detection.

The electron capture detector is a highly sensitive detector, responding to picograms of halogenated pesticides. However, it is also highly sensitive to compounds such as phthalate esters and nitroaromatics which do not contain halogens and, therefore, is not selective. Because of this lack of selectivity the extracts from OWC-12, 13 and 14 were re-concentrated to a final volume of 1.0 ml and analyzed by capillary gas chromatography with Hall electrolytic conductivity detection. This system was utilized for two reasons:

- 1) Capillary chromatography provides greater resolving power than packed column chromatography enabling the separation of more sample components and consequently reducing the number of potential interferences.
- 2) The electrolytic conductivity detector operated in the halogen mode is highly selective, responding only to halogenated compounds, but lacks the sensitivity of the electron capture detector. Due to the lower sensitivity the extracts were concentrated to 1.0 ml.

Compounds detected by both procedures provides strong evidence that the peaks detected and quantitated in the initial analyses have been correctly identified. Results of the confirmatory analyses of the organochlorine pesticides are outlined below:

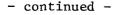
- 1) All pesticides reported for OWC-12 have been confirmed. All pesticides except DDE and DDD have been confirmed for OWC-13. Since the confirmatory procedure detection limit is approximately 5 ug/1 the pesticides in OWC-14 could not be confirmed.
- 2) The alpha and delta isomers of BHC were identified during the confirmatory analyses. These isomers were not quantitated, however, comparison with standards indicates that the concentrations are greater than 50 ug/1 in OWC-12 and OWC-13.
- 3) Kelthane was not previously analyzed because it did not elute properly from the gas chromatograph. Kelthane did elute properly from the confirmatory system and was not detected in the three samples at a detection limit of 5 ug/1.
- 4) The major components in the samples have been identified. Several small peaks were detected in OWC-12 and OWC-13 but not identified since they represent relatively low levels of contamination.

### Phenoxy-Acid Herbicides Analyses

The samples were analyzed in accordance with "Method for Chlorinated Phenoxy Acid Herbicides in Industrial Effluents" published in the Federal Register, Vol. 38, No. 75, Pt. II. This procedure involves extraction of the phenoxy acids from acidified water with diethyl ether followed by hydrolysis of the esters to acids. The extract is then solvent washed to remove pesticide interferences. The acids are then re-extracted into an organic solvent and converted to methyl esters. The extract is cleaned up by passing it through a micro-adsorption column and analyzed by gas chromatography with electron capture detection.

For reasons outlined in the section discussing organochlorine pesticides two herbicide extracts, OWC-8 and OWC-11 were confirmed by capillary gas chromatography analyses with Hall electrolytic conductivity detection. The results are outlined below:

- 1) The herbicides 2,4-D and 2,4,5-T were confirmed in both samples.
- 2) Silvex (2,4,5-TP) has been identified as a significant component in both samples. A quantitative standard was not available to determine approximate concentrations in the samples.
- 3) Two peaks of significance were detected but not identified. Further research and analyses would be necessary to identify the peaks.



# TABLE F-9 CHEMICAL ANALYSES

Observation Well: OWC - 10

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-26-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled:

2-24-81

Time Sampled:

14:15

#### STANDARD CHEMICAL -WATER ANALYSIS-

| CATIONS                              |          |                   |        |          |             | ANALYSIS                      |   |
|--------------------------------------|----------|-------------------|--------|----------|-------------|-------------------------------|---|
| CALCIUM                              | CA+2     | MG/L              |        |          |             | 83.00                         |   |
| IRON                                 | FE+2     | -MG/L-            |        |          |             | 2.43                          |   |
| MAGNESIUM                            | MG+2     | MG/L              |        |          |             | 24.00                         |   |
| MANGANESE                            | MN+2     | MG/L-             |        |          |             | 3.00                          |   |
| POTASSIUM                            | K +1     | MG/L              |        |          |             | 2.60                          |   |
| <br>SODIUM                           | NA+1     | - 14G <i>/</i> -L |        |          |             | 62 <del>+00</del>             |   |
| <br>ANIONS                           |          |                   |        |          | <del></del> |                               |   |
|                                      | HC03-1   | MG/L              |        |          |             | 323.04                        |   |
| CARBONATE                            |          |                   |        |          |             | 0-13                          | <del></del>                                   |
| CHLORIDE                             |          | MG/L              |        |          |             | 112.00                        |   |
| FLUORIDE                             |          |                   |        |          |             | 0.20                          |   |
| HYDROXIDE                            | OH -1    | MG/L              |        |          |             | 0.00<br>                      |   |
|                                      |          |                   |        |          |             |                               |   |
| PHOSPHATE                            | F04 -3   | MG/L              |        |          |             | 0.46<br>115 <del>.00-</del> - |   |
| SULFATE                              | SIO4-4   |                   |        |          |             | 0.03                          |   |
| <br>SILICATE                         | 5104-4   | MG/L              |        |          |             |                               | ·   |
| SILICA                               |          |                   |        | 5102     | MG/L        | 34.24                         |   |
| TOTAL FREE CARBO                     |          |                   |        | C02      |             | <del>269+57</del>             | <u> </u>                                      |
| EQUILIBRIUM CARE                     |          |                   |        | CO2      | MG/L        | 44.81                         |   |
| TOTAL DISSOLVED                      |          | CAL-              |        | CACO7    | MG/L        | <del>776-84</del>             |   |
| TOTAL ALKALINITY                     |          |                   | AS     | CACO3-   | MG/L        | 264.93<br>                    |   |
| CALCIUM ALKALIN:<br>MAGNESIUM ALKAL! |          |                   | AS     |          | MG/L        | 57.43.                        |   |
| SODIUM ALKALINII                     |          |                   |        |          |             |                               |   |
| TOTAL HARDNESS                       |          |                   | AS     | CACO3    | MG/L        | 305.80                        |   |
| CALCIUM HARDNESS                     |          |                   |        |          |             | 207.50                        |   |
| MAGNESIUM HARDNE                     |          |                   | AS     | CACO3    | MG/L        | 98.64                         |   |
| NON-CARBONATE HA                     |          |                   |        |          |             | 40.86                         |   |
| CALCIUM NON-CARI                     |          |                   |        | 01.000   | MG/L        | 0.00                          |   |
| MAGNESIUM NON-C                      |          |                   |        | <u> </u> | MG/L        | 41.21.                        | . <u>.                                   </u> |
| ក្អ                                  |          |                   | PH     | UNITS    |             | 6.62                          |   |
| EQUILIBRIUM PH                       | (PHS)    | <b>.</b>          | -FH.   | UNITS    |             |                               |   |
| STABILITY INDEX                      |          |                   | FΉ     | UNITS    |             | 7.85                          |   |
| <br>SATURATION INDEX                 | •        |                   |        | UNITS.   |             |                               |   |
| TEMPERATURE                          |          |                   |        | ENHEIT   |             | 68.00                         |   |
| CONDUCTIVITY, ME                     |          |                   | CEOM   | HOSKEM   | ·           |                               | <del></del>                                   |
| IONIC STRENGTH                       |          |                   |        |          |             | 0.0148                        |   |
| ION BALANCE ERRO                     | OR (PERC | ENTY              | BY –€. | ONCENTA  | ATION -     |                               |   |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

TABLE F-9 CHEMICAL ANALYSES

Observation Well: OWC - 10

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-26-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: 14:15

STANDARD -CHEMICAL -WATER-ANALYSIS-

DATE: 43 MARCH 1981

|      | CATIONS                            |                     |              |                   |   | LABORATORY<br>ANALYSIS |     |
|------|------------------------------------|---------------------|--------------|-------------------|---|------------------------|-----|
|      | CALCIUM                            | CA+2                | MG/L         |                   |   | 83.00                  |     |
|      | IRON                               | FE+2:               |              | Į.                | 7.00                                    | 2443                   |     |
|      | MAGNESIUM<br>MANGANESE             | MG+2<br>MN+2        | MG/L<br>MG/L |                   |   | 24.00<br>- 3.00        |     |
|      | POTASSIUM                          | K +1                | MGZI         |                   |   | 2,60                   |     |
| 12   | SODIUM -                           | NA+1                | 46/L         |                   |   | 82+00                  |     |
|      | ANIONS                             |                     |              |                   |   |                        |     |
|      | BICARBONATE                        | HC03-1              | MG/L         |                   |   | 323.04                 |     |
|      | CARBONATE                          | C03 -2              | MG/L         |                   |   | 0.13                   |     |
|      | CHLORIDE                           | CL -1               |              |                   |   | 112.00                 |     |
|      |                                    |                     | MG/L         |                   |   | 0.20                   |     |
|      | HYDROXIDE                          | OH -1               | MG/L         |                   |   | 0.00                   |     |
|      | NITRATE                            | FO4 -3              |              | -                 |   | 0.46                   |     |
|      | SULFATE                            |                     | MG/L         |                   |   | 115.00                 |     |
|      | SILICATE                           | SI04-4              |              |                   |   | 0.03                   |     |
|      | SILICA                             |                     |              | 5102              |   | 34.24                  |     |
| 66.7 | TOTAL FREE CARB                    |                     |              |                   |   | 269.57                 |     |
|      | EQUILIBRIUM CAR<br>TOTAL DISSOLVED |                     |              | C02               | MG/L<br>MG/L                            | 44.81<br>              | 191 |
|      | TOTAL ALKALINIT                    |                     | AS           | CAC03             | MG/L                                    | 264.93                 |     |
|      | CALCIUM ALKALIN                    |                     |              | CACO3             |   | 207.50-                |     |
|      | MAGNESIUM ALKAL                    |                     | AS           | CACO3             | MG/L                                    | 57.43                  |     |
|      | SODIUM ALKALINI                    | TY                  | -            | -CAC03-           |   | 0+00                   |     |
|      | TOTAL HARDNESS                     |                     | AS           | CAC03             | MG/L                                    | 305.80                 |     |
|      | CALCIUM HARDNES                    |                     | u – e AS     |                   | MG/L                                    |                        |     |
|      | MAGNESIUM HARDN<br>NON-CARBONATE H |                     | AS           | CAC03             | MG/L                                    | 98 <b>.64</b>          |     |
|      | CALCIUM NON-CAR                    |                     |              | <del>60665-</del> | MG/L                                    | 0.00                   |     |
|      | MAGNESIUM NON-C                    |                     |              |                   |   |                        |     |
|      | PH                                 |                     | PH           | UNITS             |   | 6.62                   |     |
|      | EQUILIBRIUM PH                     | (PHS) = I           |              | - UNITS           |   |                        |     |
|      | STABILITY INDEX                    |                     | F·H          | UNITS             |   | 7.85                   |     |
|      | SATURATION INDE                    |                     |              | UNITS             | 100000                                  | 0-62                   |     |
|      | TEMPERATURE                        | DEGR                |              | ENHEIT            |   | 68,00                  |     |
|      | CONDUCTIVITY, M                    |                     |              | HUSZUM:           | ·                                       | 0.0148                 |     |
|      | IONIC STRENGTH ION BALANCE ERR     | THULARD<br>OD ZEFER | יבאדו פי י   | מאר באידי         | EATTON                                  |                        |     |
|      | TOUR DAMENGE THUS                  | ON THEM             | THE PLANE    |                   | 111111111111111111111111111111111111111 |                        |     |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

# TABLE F-10 CHEMICAL ANALYSES

Observation Well: OWC - 11

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

2-26-81 Date Received:

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: 15:30

|     | ANALYSIS                              | CONCEN      | TRATION           | UNITS             |            | BOOK/PAGE              |
|-----|---------------------------------------|-------------|-------------------|-------------------|------------|------------------------|
| ä   | LAB NUMBER: 8102-0704A                |             |                   | OWC-11 CHEVRON    |            |                        |
|     |                                       | SEELIAL IN  | BIRDCITUR         | IS FILLEN-DEASS   | r IBEN     |                        |
|     | DATE SAMPLED                          | 27          | 24/81             |                   |            |                        |
|     | TIME SAMPLED                          |             | :30               |                   | ESS        | /                      |
|     | ALDRIN                                |             |                   | UG/L              | - C.B.     | 132 / -21              |
|     | CHLORDANE                             |             |                   | UG/L              | CJB        |                        |
|     | 4,4-000                               | 1.          | 46                | UG/L              | C4#        | 132 / 21               |
|     | 4,4-IIIE                              | NE          | (0.20)            | UG/L              | CJB        | 132 / 21               |
|     | 4,4-DDT                               | 1.          | 46                | UG/L              | CAB        | 132 / 21               |
|     | DIELDRIN                              |             |                   | -UG/L -= - 130    | · ——CJB—   | <del>132 / 21</del> ·  |
|     | ENDRIN                                |             | 55                | UG/L              | CJB        | 132 / 21               |
|     | HERTACHLOR                            | IN          | ((0.10)           | UG/L -            |            | - 132 / 21-            |
|     | MALATHION                             | 5.          |                   | UG/L              | CJB        | 132 / 23               |
|     | SEVIN                                 |             |                   | UG/L              |            | 132 / 21               |
|     | 2,4,5-T                               |             | 8 · B             | UG/L              | CJB        | 132 / 22               |
|     | TOXAPHENE                             |             |                   | UG/L              |            | 132 -√ -21             |
| 4   | PCB<br>LINDANE                        | 10          | (10.0)            | UG/L              | CJB        | 132 / 21               |
|     | METHOXYCHLOR                          |             | 1(0.8)            | UG/L              | CJB        | 132-/-21-<br>132 / 21  |
| , 1 | 2,4-D                                 |             | 300               |                   | C-JB       |                        |
| 1   | MIREX                                 |             | (0.5)             | UG/L              | CJB        | 132 / 21               |
|     | CAPTAN                                | IM          | (0.20)            | UG/L              | CJB        |                        |
|     | DIFOLATAN                             | NI          | (20)              | UG/L              | CJB        | 132 / 21               |
|     | CHLOROBENZILATE                       |             | 3(0.30)           | -UG/L -           |            | 432 /-21-              |
|     | GUTHION                               |             | (100)             | UG/L<br>UG/L      | CJB        | 132 / 23               |
| ŧ.  | DIAZINON                              |             | L <u>i</u> 1      | UG/L              |            | 132/23                 |
| •   | PARATHION, METHYL<br>PARATHION, ETHYL |             | .5<br>3(0.5)      | UG/L              | CTB        | 132 / 23<br>           |
|     | TRITHION                              |             | T ANAL.           | UG/L              | CIB        | 170 / 21               |
|     | PHOSDRIN (MEVINPHOS)                  | = MI        | 1(2.0)            | UG/L              | CJB        | 32 / 23.               |
|     | CONCLUSIONLAB NUMBE                   | R: 8102-070 | 24A               | to the page       |            |                        |
|     |                                       |             |                   |                   |            | -                      |
|     |                                       |             |                   |                   |            |                        |
|     |                                       |             |                   |                   |            |                        |
|     | LAR NUMBER: 8102-07048                |             |                   |                   |            |                        |
|     |                                       | SPECIAL IN  | NSTRUCTION        | 15: FILTERED IN F | IELD       |                        |
|     | ARSTRIC                               |             |                   | VO. //            |            |                        |
|     | TANTIUM                               |             | .11<br>.0010      | MG/L<br>MG/L      | BTF        | 131 / 51               |
|     | COTTER                                |             | .0034             | MG/L-             | RCR<br>RCR | 130 / 196<br>          |
|     | ZINC                                  |             | .061              | MO/L              | RCR        | 130 / 192              |
|     | CONCLUSIONLAR NUMBE                   |             |                   | 1107 L            | KUK        | 130 / 172              |
|     |                                       |             |                   |                   |            |                        |
|     |                                       |             |                   |                   |            |                        |
|     |                                       |             |                   |                   |            |                        |
|     | LAR NUMBER: 8102-07040                | SAMPLE DES  | SCRIPTIONS        | OWC-11 CHEVRON    |            |                        |
|     |                                       | SPECIAL IN  | <b>YSTRUCTION</b> | VS: NO PREF       |            |                        |
| C   | ALKALINITY, TOTAL                     | 17          | 70                | MG/L+ AS CACO3    | BLD        | 47 / 91                |
|     | CALCIUM, BY EDTA TITRAT               |             |                   | MG/L              |            | 82/-32-                |
|     | CHLORIDE                              | 26          |                   | MG/L              | RLD        | 108 / 35               |
|     | FLUORILE                              | 0.          | 165               | MG/L              | CJA        | -25 / 94               |
|     | IRON, TOTAL                           |             | 11                | MG/L              | RCR        | 130 / 186              |
| 0 V | MAGNESIUM                             | 47          |                   |                   |            | 130- / 190             |
|     | MANGANESE                             |             | 17                | MG/L              | RCR        | 130 / 186              |
|     | NITRATE -                             |             |                   | MG/L-AS-N         |            |                        |
| t   | ORTHOPHOSPHATE<br>PH                  |             | 10                | MG/L AS P         | BLD        | 128 / 9                |
|     | POTASSIUM                             |             | .50<br>.3         | MG/L              |            | 83/76                  |
| 1.  | SILICON                               | 16          |                   | MG/L              | RCR        | 130 / 188<br>130 / 190 |
| (   | SODIUM                                | 65          |                   | MG/L              | RCR        | 130 / 188              |
|     | SPECIFIC CONDUCTANCE                  |             |                   | UMHOS/CH          |            | -124-/-11              |
|     | SULFATE                               | 12          | 25                | MG/L              | BLD        | <b>95</b> / 38         |
|     | TOTAL ORGANIC CARBON                  | -21         | 6 14              | MG/L              |            | -85 / 69-              |
|     | CONCLUSIONLAB NUMBE                   | R: 8102-070 | )4C               |                   |            |                        |
|     |                                       |             | 1.5               | 8 096 95          |            |                        |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45 $\mu$  membrane) and acid preserved in the field.

TABLE F-10
CHEMICAL ANALYSES

Observation Well: OWC - ||

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-26-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-24-81

Time Sampled: 15:30

-STANDARD CHEMICAL WATER ANALYSIS

DATE: 13 MARCH 1981

LARGRATORY FILE NO.: 81-9521 LABORATORY NO.: 8102-0704C SAMPLE RECEIVED 26 FEBRUARY 1981

|     |                 | 11.14               |        |                   |          |         | LABORATORY          |  |
|-----|-----------------|---------------------|--------|-------------------|----------|---------|---------------------|--|
|     | CATIONS         | Value of the second |        |                   |          |         | ANALYSIS            |  |
|     | CALCIUM         | CA+2                | MG/L   | W. S. S. S. S. S. |          |         | 130.00              |  |
|     | IRON            | EE+2                | -4G/L  |                   |          |         | 0,11                |  |
|     | MAGNESIUM       | MG+2                | MG/L   |                   |          |         | 47.00               |  |
|     | MANGANESE       | MN+2                | -MG/L  |                   |          |         | 2.17                |  |
|     | POTASSIUM       | K +1                | MG/L   |                   |          |         | 2.30                |  |
|     | SODIUM          | NA+1:               | -MG/L  | -                 |          |         | -65.00              |  |
|     | AUTONO          |                     |        |                   |          |         |                     |  |
|     | ANIONS          |                     |        |                   |          |         |                     |  |
|     | BICARBONATE     | HC03-1              | MG/L   |                   |          |         | 207.25              |  |
|     |                 | ∘03 <del>-</del> 2- | - MG/L |                   |          |         | 0.07                |  |
|     | CHLORIDE        | CL -1               | MG/L   |                   |          |         | 264.00              |  |
|     | FLUORIDE        | y-Fyg <b>1</b>      |        |                   |          |         | 0.17                |  |
|     | HYDROXIDE       | OH -1               | MG/L   |                   |          |         | 0.00                |  |
| 50% | NITRATE -       | N03 -1              |        |                   |          |         | 1.77                |  |
|     | PHOSPHATE       | F04 -3              | MG/L   |                   |          |         | 0.31                |  |
|     | SULFATE         | S04 -2              |        |                   |          |         | -125 <del>-00</del> |  |
|     | SILICATE        | SIQ4-4              | MG/L   |                   |          |         | 0.02                |  |
|     | SILICA          |                     |        |                   | 8102     | MG/L    | 34.24               |  |
|     | TOTAL FREE CARB | ON DIOXI            | DE     |                   |          |         | 236.89              |  |
|     | EQUILIBRIUM CAR |                     |        |                   | C02      | MG/L    | 27.56               |  |
|     | TOTAL DISSOLVED | SOLIDS              | (CAL-  | C-)               |          |         |                     |  |
|     | TOTAL ALKALINIT | Y                   |        | AS                | CACO3    | MG/L    | 169.94              |  |
|     | CALCIUM ALKALIN | ITY -               |        | -AS-              | -CACO3-  | -MG/L-  | 167-74              |  |
|     | MAGNESIUM ALKAL | YTINI               |        | AS                | CACO3    | MG/L    | 0.00                |  |
|     | SODIUM ALKALINI | TY                  | -      | AS.               | CACO3    | MG/L -  | 0.00                |  |
|     | TOTAL HARDNESS  |                     |        | AS                | CACO3    | MG/L    | 517.66              |  |
|     | CALCIUM HARDNES | S                   | S 10 W | AS                | CACO3    | MG/L -  | 325.00-             |  |
|     | MAGNISIUM HARDN | ESS                 |        | AS                | CACG3    | MG/L    | 193.17              |  |
|     | NON-CAPBONATE H | ARDNESS.            |        | AS-               | - CACO3- | -MG/L-  | -IIII 347.72        |  |
|     | CALCIUM NON CAR | DONATE H            | DRIBAL | 55                |          | MG/L    | 155.06              |  |
|     | MAGNESIUM NON-C | ARBONATE            | HARD   | NESS              |          | MG/L    | 193.17              |  |
|     | FR              |                     |        | FH                | STINU    |         | 6.50                |  |
|     | EQUILIBRIUM PH  | (FHS)               | ~      | ₽Ή                | UNITS    |         | - 7.25              |  |
|     | STABILITY INDEX |                     |        | FΉ                | UNITS    |         | 8.00                |  |
|     | SATURATION INDE | X - 1921            | M      |                   | -UNITS-  |         | -0.75               |  |
|     | TEMPERATURE     | DEGR                | EES    | FAHR              | ENHEIT   |         | 48.00               |  |
|     | CONDUCTIVITY, M | EAGURED             | HI     | CROM              | HOS/CM-  | %       | 1540.00             |  |
|     | IONIC STRENGTH  | (MOLAR)             |        |                   |          |         | 0.0199              |  |
|     | TON PALANCE ERR | OR (PERC            | ENT    | BY C              | DNCENTR  | ATION - | -0.65               |  |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45 $\mu$  membrane) and acid preserved in the field.

## TABLE F-II CHEMICAL ANALYSES

Observation Well: OWC - 12

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-26-81

Time Sampled: 11:45

| DATE SAMPLED   | CACO3  CJA B2 FLD 10 CJA 25  CJA 25  CJA 10  CJA 10  BLB 12  LKN 83  LKN 83  CJB 13  | AS CACO3  CJA 82 / 32  BLB 108 / 35  CJA 25 / 94  /  AS N CJA 109 / 32  ELN 83 / 78  LKN 83 / 78  /  CM MJB 124 / 11  GMD 65 / 69  2  TER CLASS FIBER  CJR 132 / 21  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  CJR 132 / 23  | ANALYSIS  |   |  | ANALYST BOOK/PAG    |
|--|--|--|---|---|--|---------------------|
| DATE SAMPLED   | CACO3  CJA B2  BLD 10  CJA 25  /  CJA 10  BLB 12  LKN B3  -/  MJB 12  GMD 85  GMD 85  GJR 13  CJR 13   | AS CACO3  CJA 82 / 32  FLB 108 / 35  CJA 25 / 94  /  /  /  /  /  /  /  /  /  /  /  /  /  | LAB NUMBER: 8102-0783A SAI<br>SPI   | MPLE DESCRIPTIO   | N: OWC-12<br>ONS: NO PREP                    | ***                 |
| TIME SAMPLED 1145  ALKALINITY, TOTAL  CALCIUM, BY EDIA TITRATION 88 MG/L  CHLORIDE 20 MG/L  FLUORIDE 0.34 MG/L  ARGALSTUM MG/L  MANGANESE MG/L  NITRATE 0.3 MG/L AS N CJR  ORTHOPHOSPHATE 0.05 MG/L  ORTHOPHOSPHATE 0.05 MG/L  SULFASSIUM MG/L  SULFASSIUM MG/L  SULFASSIUM MG/L  SULFATE 0.3 MG/L AS N CJR  ORTHOPHOSPHATE 0.05 MG/L AS N CJR  ORTHOPHOSPHATE 0.05 MG/L  SULFATE 0.06 MG/L  SULFATE 0.06 MG/L  SULFATE 0.06 MG/L  CONCLUSION LAB NUMBER: 8102-0783A MG/L  CHENTAL ORGANIC CARBON 5.5 MG/L  CHE | CACO3  CJA 82  BLB 10  CJA 10  CJA 10  BLB 12  LKN 83  MJB 12  GMD 85  GLASS FIBER   CJB 13  | AS CACO3  CJA 82 / 3:  FLD 108 / 3:  CJA 25 / 9:  CJA 25 / 9:  CJA 25 / 9:  CJA 25 / 9:  CJA 25 / 9:  CJA 25 / 9:  CJA 25 / 9:  CJA 25 / 9:  CJA 25 / 9:  CJA 109 / 3:  CJA 109 / 3:  CJA 109 / 3:  CJA 109 / 3:  CJA 109 / 3:  CJA 128 / 9:  LKN 83 / 7:  CM MJB 124 / 1:  CM MJB 124 / 1:  CM MJB 124 / 1:  CJB 132 / 2:  CJB 12:  CJB 12:  CJB 12:  CJB 12:  CJB 12:  CJB 12:  CJB 12:  CJB 12:  CJB 12:  CJB 12:  CJ |   |   |  |                     |
| ALKALINITY, TOTAL CALCIUM, BY EDIA TITRATION BB MG/L CALCIUM, BY EDIA TITRATION BB MG/L CALCIUM, BY EDIA TITRATION BB MG/L CALCIUM, BY EDIA TITRATION BB MG/L CALCIUM, BY EDIA TITRATION BB MG/L CALCIUM, BY EDIA TITRATION BB MG/L CALCIUM, BY EDIA TITRATION BB MG/L CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION BB MG/L CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BACK CALCIUM, BY EDIA TITRATION CALCIUM, BY EDIA TITRATION CALCIUM, BACK CAL | CJA 82  FLB 10  CJA 25  CJA 25  CJA 25  CJA 10  FLB 12  LKN 83  CJB 13   | CJA 82 / 3  BLD 108 / 3  CJA 25 / 9  /  CJA 25 / 9  /  /  AS N CJA 109 / 3  ELB 128 / 9  LKN 83 / 7  /  /  /  /  CM MJB 124 / 1  GMD 85 / 69  CJB 132 / 2  |   |   |  |                     |
| CHLORIDE CHU | CJA 82  FLB 10  CJA 25  CJA 25  CJA 25  CJA 10  FLB 12  LKN 83  CJB 13   | CJA 82 / 3 BLD 108 / 3 CJA 25 / 9  / AS N CJA 109 / 3 SS-F BLB 128 / 9 LKN 83 / 7  / / / / / / / / / / / / / / / / /   |   |   | MG/L - AC CACOZ                              |                     |
| CHLORIDE   | GLASS FIBER  CJA 10  CJA 10  BLB 12  LKN 83  LKN 83  CJB 13  | CJA 25 / 9  CJA 25 / 9  /  /  SS N CJA 109 / 3  SS-F BLD 128 / 9  LKN 83 / 7  /  CM MJB 124 / 1  GMD 85 / 6  CJB 132 / 2  | CALCIUM, BY EDTA TITRATION  | 88  | MG/I   | C IA B2 4 7         |
| FLUDRIBE  1RON, TOTAL  MAGNESIUM  MANDANESE  MARCH MG/L  SULFASIUM  MARCH MG/L  SULFASIUM  MARCH MG/L  SULFATE  TOTAL ORGANIC CARBON  TOTAL ORGANIC CARBON  TOTAL ORGANIC CARBON  SEPECIAL INSTRUCTIONS: FILTER CLASS FIBER  ALDRIN  ALDRIN  ALDRIN  T.7 UG/L  CJF  ALDRIN  ALDRIN  T.7 UG/L  CJF  ALDRIN  ALDRIN  T.7 UG/L  CJF  ALDRIN  ALDRIN  T.7 UG/L  CJF  ALA-DDD  MD(0.20) UG/L  CJF  ALA-DDD  MD(0.20) UG/L  CJF  MALA-TIDE  MR(0.20) UG/L  CJF  MALA-TIDE  MR(0.10) UG/L  CJF  MALA-TIDN   | CJA 25  / CJA 10  PLD 12  LKN 83   | CJA 25 / 9  //  //  //  //  //  //  //  //  //   | CHLORIDE  | 20  | - MG/1:                                      | PI-D 100 / 3        |
| IRON, TOTAL   MG/L      | CJA 10 BLB 12 LKN 83  MJB 12  GMD 85  GMD 85  GMD 85  CJR 13 CJR  | CJA 109 / 3  SF P BLB 128 / 9  LKN 83 / 7  CM MJB 124 / 1  GMD 85 / 6  CJB 132 / 2  |   |   |  | CIA 75 / 0          |
| MANGANESE  MITRATE  M | CJA 10 BLB 12 LKN 83  / MJB 12  GMD 85  GMD 85  GLASS FIBER  CJR 13 CJR  | S N  |   |   | MG/L-  |                     |
| ORTHOFHOSPHATE   | CJA 10 BLB 12 LKN 83  / MJB 12  GMD 85  GMD 85  GLASS FIBER  CJR 13 CJR  | S N  |   |   | MG/L   | ,                   |
| ORTHOPHOSPHATE O.05  | CJA 10 BLB 12 LKN 83  / MJB 12  GMD 85  GMD 85  GLASS FIBER  CJR 13 CJR  | S N  |   |   | MG/L   |                     |
| TOTASSIUM  | LKN 83  MJB 12  GMD 85  GMD 85  GMD 85  GMD 85  GJR 13   | LKN 83 / 7  //  //  CM MJB 124 / 1  GMD 85 / 6  GMD 85 / 6   CJB 132 / 2  GJR 132 / 2  GJR 132 / 2  CJB 132 / 2  |   | 0.3   | MGZI AC M                                    | CJA 109 / 3         |
| POTASSIUM  | GMD 85  GMD 85  GMD 85  GMD 85  GMD 85  GJR 13  GJR 13  GJR 13  CJR 13   | CM MJB 124 / 1  GMD 85 / 6  GMD 85 / 6  CJB 132 / 2  GJR 132 / 2  CJB 132 / 2  |   |   |  |                     |
| SILICON  | GMD 85  GMD 85  GMD 85  GMD 85  GMD 85  GJR 13  GJR 13  GJR 13  CJR 13   | CM MJB 124 / 1  GMD 85 / 6  GMD 85 / 6  CJB 132 / 2  GJR 132 / 2  CJB 132 / 2  |   | 7.20  | - MC /I                                      | LKN 83 / 7          |
| SOBTUM SPECIFIC CONDUCTANCE 859 UMHOS/CM MJE SPECIFIC CONDUCTANCE 859 UMHOS/CM MJE SULFATE   | MJB 12  GMD 85  GMD 85  GMD 85  GMD 85  GJB 13  GJF 13  CJB 13   | CM MJB 124 / 1  GMD 85 / 6  GMD 85 / 6  CJB 132 / 2  GJR 132 / 2  GJR 132 / 2  CJB 132 / 2  |   |   | MG ZI  |                     |
| SPECIFIC COMDUCTANCE   859   | MJB 12  GMD 85  GMD 85  GMD 85  CJR 13   | CM MJB 124 / 1  GMD 85 / 6  2  TER CLASS FIBER   CJB 132 / 2  GJR 132 / 2  CJB 132 / 2  | SODIUM .  | 121.0   | MGZI   | 0 400 0 10 10 10 10 |
| CALE      | GMD 85  CLASS FIBER  CJB 13  | GMD 85 / 6  Z TER GLASS FIRER   CJB 132 / 2  | SPECIFIC CONDUCTANCE  | 859   | UMHOS/CM                                     | M IR 124 / 1        |
| CONCLUSIONLAB NUMBER: 8102-0783A - GMI  LAB NUMBER: 8102-0783B SAMPLE DESCRIPTION:-OWC-12  SPECIAL INSTRUCTIONS: FILTER CLASS FIBER  ALDRIN 17.7 UG/L CJF CHLORDANE ND(1.0) UG/L CJF 4.4-DDD ND(0.20) UG/L CJF 4.4-DDD ND(0.20) UG/L CJF DIELDRIN 7.8 UG/L CJF ENDRIN 4.3 UG/L CJF ENDRIN 4.3 UG/L CJF ENDRIN 4.3 UG/L CJF MALATHION 223 UG/L CJF MALATHION 223 UG/L CJF MALATHION 1.2 UG/L CJF TOXAFHENE ND(10.0) UG/L CJF TOXAFHENE ND(10.0) UG/L CJF TOXAFHENE ND(10.0) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.8) UG/L CJF ALTHOXYCHLOR ND(G.9) UG/L CJF  | GMD 85  CLASS FIBER  CJB 13  | GMD 85 / 6  Z TER GLASS FIRER   CJB 132 / 2  |   |   | - MG/L                                       | 127/1               |
| LAB NUMBER: 8102-0783B SAMPLE DESCRIPTION:-DWC-12 SPECIAL INSTRUCTIONS: FILTER GLASS FIBER  ALDRIN CHLORDANE A,4-DDD ND(0.20) UG/L A,4-DDT ND(0.20) UG/L SPECIAL INSTRUCTIONS: FILTER GLASS FIBER  ALDRIN CHLORDANE ND(0.20) UG/L CJE A,4-DDT A,8 UG/L CJE ENDRIN A,3 UG/L CJE ENDRIN A,3 UG/L CJE ENDRIN A,3 UG/L CJE ENDRIN A,3 UG/L CJE ENDRIN A,3 UG/L CJE ENDRIN A,3 UG/L CJE ENDRIN AD ANAL. UG/L CJE SEVIN NOT ANAL. UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE ND(10.0) UG/L CJE CSE CSE ND(10.0) UG/L CJE CSE CSE ND(10.0) UG/L CJE CSE CSE ND(10.0) UG/L CJE CSE CSE ND(10.0) UG/L CJE CSE CSE ND(10.0) UG/L CJE CSE CSE ND(10.0) UG/L CJE CSE CSE ND(10.0) UG/L CJE CSE CSE ND(10.0) UG/L CJE CSE CSE CSE ND(10.0) UG/L CJE CSE CSE CSE ND(10.0) UG/L CJE CSE CSE CSE ND(10.0) UG/L CJE CSE CSE CSE CSE ND(10.0) UG/L CJE CSE CSE CSE CSE CSE CSE CSE CSE CSE CS  | CLASS FIBER  CJR 13 CJR 13 CJR 13 CJB | 2 TER CLASS FIRER  CJR 132 / 2 CJR 132 / 2 CJB 132 / 2   | TOTAL ORGANIC CARBON  | 5.5   | MG/L   | GMD 85 / A          |
| CAB NUMBER: 8102-0783B   SAMPLE DESCRIPTION:-OWC-12  | CLASS FIBER  CJR 13 CJR 13 CJR 13 CJB | 2 CJB 132 / 2 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 12 CJB 1 | concensionFar Nowber: 6   | 3102-0783A  | 5 5 ESS 55K                                  |                     |
| SAMPLE DESCRIPTION:-OWC-12   SPECIAL INSTRUCTIONS: FILTER CLASS FIBER  | CLASS FIBER  CJR 13 CJR 13 CJR 13 CJB | 2  |   |   | 0  |                     |
| SPECIAL INSTRUCTIONS: FILTER CLASS FIBER   | CLASS FIBER  CJR 13 CJR | CJR 132 / 2 CJR 13 | LAR NUMBER! 0100-07075 CA   |   |  |                     |
| ### ### ### ### ### ### ### ### ### ##   | CJB 13   | CJB 132 / 2  | SPE   | TOTAL INSTRUCTT   | ONS! ETLIED CLACC C                          | IBER                |
| ### ### ### ### ### ### ### ### ### ##   | CJB 13   | CJB 132 / 2  | ALURIN  | 17.7  | UG/L   |                     |
| NB(0.20) - Un/L  | CJB 13   | CJB 132 / 2 CJB 13 |   | ND(1+0)   | UG/L   | CJB 132 / 2         |
| ### ### ### ### ### ### ### ### ### ##   | CJB 13   | CJB 132 / 2  |   | ND(0.20)  | UG/L   | CJB 132 / 2         |
| 4.8  | CJE 13 CJB 13   | CJE 132 / : CJB 132 / : CJB 132 / 2  |   | ME(0+50) =  | - Uii/L                                      | - CJB 132 / 2       |
| ENDRIN  4.3 UG/L CJB  HEFTACHLOR  ND(0.10) UG/L CJB  SEVIN  NOT ANAL. UG/L CJB  22.4,5-T 1.2 UG/L CJB  TOXAPHENE  ND(10.0) UG/L CJB  TOXAPHENE  ND(10.0) UG/L CJB  ND(10.0) UG/L CJB  ATT UG/L CJB  MD(10.0) UG/L CJB  MD(10.0) UG/L CJB  ATT UG/L CJB  ATTHOXYCHLOR  ND(G.8) UG/L CJB  ATTHOXYCHLOR  ND(0.5) UG/L CJB  ATTREX  ND(0.5) UG/L CJB  ATTREX  ND(0.5) UG/L CJB  ATTROXAPTAN  ND(0.5) UG/L CJB  ATTROXAPTAN  ND(0.5) UG/L CJB  ATTROXAPTAN  ND(0.5) UG/L CJB  ATTROXAPTAN  ND(0.5) UG/L CJB   | CJB 13 CJP 14 CJP 15 CJB 13  | CJB 132 / 2    |   | 4.8   | UG/L   | CJB 132 / 1         |
| 4.3 UG/L CJE HAEFTACHLOR ND(0.10) UG/L CJE MALATHION 22.3 UG/L CJE SEVIN NOT ANAL. UG/L CJE 2,4,5-T 1.2 UG/L CJE TOXAFHENE ND(10.0) UG/L CJE TOXAFHENE ND(10.0) UG/L CJE TINDANE 417 UG/L CJE TETIIOXYCHLOR ND(6.8) UG/L CJE 2,4-D ND(1.0) UG/L CJE TIREX ND(0.5) UG/L CJE CAPTAN ND(0.20) UG/L CJE OAFTAN ND(0.20) UG/L CJE OAFTAN ND(0.20) UG/L CJE OAFTAN ND(0.20) UG/L CJE OAFTAN ND(0.20) UG/L CJE OAFTAN ND(0.20) UG/L CJE OAFTAN ND(0.20) UG/L CJE OAFTAN ND(0.20) UG/L CJE   | CJB 13 CJB 14 CJB 13   | CJB 132 / 2  |   |   |  | CJB - 0132 / 2      |
| MALATHION   MD(0.10)   UG/L   CJR  | CJB 13  | CJF - 132 / 2 CJF 132 / 2  |   |   | UG/L   | CJB 132 / 2         |
| 223  | CJB 13  | CJR 132 / 2  CJB 132 / 2   |   |   | UG/L =                                       | CJF132 /- 2         |
| 1.2 UG/L CJR TDXAPHENE ND(10.0) UG/L CJR PCB ND(10.0) UG/L CJR LINDANE 417 UG/L CJR METHOXYCHLOR ND(6.8) UG/L CJR 2.4-D ND(1.0) UG/L CJR AIREX ND(6.5) UG/L CJR CAPTAN ND(6.20) UG/L CJR DIFOLATAN ND(6.20) UG/L CJR   | CJR 13 CJB 13  | CJR 132 / 2:  CJE 132 / 2:  CJE 132 / 2:  CJB 132 / 2:   |   |   | UU/L   | CJB 132 / 2         |
| TOXAFHENE ND(10.0) UG/L CJR  PCB ND(10.0) UG/L CJR  LINDANE 417 UG/L CJR  METHOXYCHLOR ND(G.8) UG/L CJR  2.4-D ND(1.0) UG/L CJR  MIREX ND(0.5) UG/L CJR  CAPTAN ND(0.20) UG/L CJR  | CJB 13 CJB 13 CJB 13 CJB 13 -CJB 13 -CJB 13 CJB 13 CJB 13 CJB 13 CJB 13 CJB 13 -CJB 13 -CJB 13 -CJB 13   | CJB 132 / 2  |   |   | 11C //                                       | - CJB 132 √ 2       |
| A17  | CJB 13 CJB 13 CJB 13 CJB 13 -CJB 13 -CJB 13 CJB 13 CJB 13 CJB 13 CJB 13 CJB 13 -CJB 13 -CJB 13 -CJB 13   | CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>  |   |   | 00/L   | UJF 132 / 2         |
| 41/ UG/L CJB<br>  WETHIOXYCHLOR   ND(G.8) UG/L CJB<br>  2,4-D   ND(1.0) UG/L CJB<br>  4TREX   ND(0.5) UG/L CJB<br>  CAPTAN   ND(0.20) UG/L CJB   | CJB 13 CJB 13 CJB 13 CJB 13 -CJB 13 -CJB 13 CJB 13 CJB 13 CJB 13 CJB 13 CJB 13 -CJB 13 -CJB 13 -CJB 13   | CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>  |   |   | UG/L   | CJB 132 / 2         |
| 41/ UG/L CJB<br>  WETHIOXYCHLOR   ND(G.8) UG/L CJB<br>  2,4-D   ND(1.0) UG/L CJB<br>  4TREX   ND(0.5) UG/L CJB<br>  CAPTAN   ND(0.20) UG/L CJB   | CJB 13 CJB 13 CJB 13 CJB 13 -CJB 13 -CJB 13 CJB 13 CJB 13 CJB 13 CJB 13 CJB 13 -CJB 13 -CJB 13 -CJB 13   | CJB 132 / 2  |   |   | UG/L   |                     |
| ND(1.0) UG/L CJB WIREX ND(0.5) UG/L -CJB CAPTAN ND(0.20) UG/L CJB DIFOLATAN ND(20) HG/L - CJB  | CJB 13<br>-CJB 43<br>CJB 13<br>-CJB 13<br>CJB 13<br>CJB 13<br>CJB 13<br>CJB 13<br>CJB 13   | CJB 132 / 2: -CJB 432 / 2: -CJB 12 / 2: -CJB 12 /  |   |   | UG/L   | CJB 132 / 2:        |
| MIREX ND(0.5) UG/L -CJB CAPTAN ND(0.20) UG/L CJB DIFOLATAN ND(20) UG/L - CJB   | -CJB 43<br>CJB 13<br>CJB - 13<br>CJB 13<br>CJB 13<br>CJB 13<br>CJB 13<br>CJB 13<br>CJB 13  | -CJF 432 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2: CJB 132 / 2:   |   |   | UG/L   |                     |
| CJB  | CJB 13. CJB 13. CJB 13. CJB 13. CJB 13. CJB 13. CJB 13. CJB 13.  | CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2  |   | MD(T+O)   | UG/L   | CJB 132 / 2.        |
| TIFOLATAN  | CJB13<br>CJB 13<br>CJB 13<br>CJB 13<br>CJB 13<br>CJB 13<br>CJB 13  | CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2<br>CJB 132 / 2  |   | MI(0.20)  | UG/L   | -UJH :: 132 / 2     |
| CHLOROBENZILATE ND(0.30) UG/L CJB  | CJB 13:<br>CJB 13:<br>CJB 13:<br>CJB 13:<br>CJB 13:<br>CJB 13:   | CJB 132 / 2:<br>CJB 132 / 2:<br>CJB 132 / 2:<br>CJB 132 / 2:<br>CJB 132 / 2:<br>CJB 132 / 2:<br>CJB 132 / 2:<br>CJB 132 / 2:   |   | NB(20)  | 11671 -                                      | CJB 132 / 2:        |
| THITIDAL   | CJB 13:<br>CJB 13:<br>CJB 13:<br>CJB 13:<br>CJB 13:<br>CJB 13:   | UJB 132 / 2;   |   | NII(0.30)   | UG/L   |                     |
| NU(100) UG/L II n ir   | CJB 13:<br>CJB 13:<br>CJB 13:<br>CJB 13:<br>CJB 13:  | GJB 132 / 23   | BUTHION   | ND(100)   | UG/L 8                                       | C.IR 132 / 2        |
| DIAZINON 4.3 UG/L CUB  | CJB 13:<br>CJB 13:<br>CJB 13:<br>CJB 13:   | GJB 132 / 23   |   | 4.3   | UG/L   | CJB 132 / 20        |
| ARATHION, METHYL 10.9 UG/L CJB   | CJB 13:<br>CJB 13:<br>CJB 13:  | GJB 132 / 23   | PARATHION, METHYL   |   | UG/L   | © CJB 132 / 2       |
| ARATHION, ETHYL 53.2 UG/L CJB  | CJB 13:  | GJB 132 / 23   | ARATHION, ETHYL   | 53.2  | UG/L   | CJB 132 / 2         |
| RITHION NOT ANAL. UG/L CJR   | CJB 13   | GJB 132 / 23   | RITHION   | NOT ANAL.   | UG/L   |                     |
| CONCLUCTOR LAT MUNICIPAL DATE OF THE CONCLUCTOR  |  |  | THUSURIN (MEVINPHOS)  | ND(2.0)   | 067L   | UJB 132 / 23        |
| CONCESSION CAP HOUSEN. SIGNOVASE   | and the second second  | - 200 - 300  | CONCEOUTOR THE HOUSEN'S   | 102-0/030   | 57 388                                       |                     |
| -CONCLUCTON LAT MUNICIPA CARD ARCHITECTURE   |  |  | CHLOROBENZILATE SUTHION PARATHION, METHYL PARATHION, ETHYL FRITHION PHOSDRIN (MEVINPHOS)CONCLUSIONLAB NUMBER: 8 | ND(0.30)<br>ND(100)<br>4.3<br>10.9<br>53.2<br>NOT ANAL,<br>ND(2.0)<br>102-0783R | UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L<br>UG/L | -                   |
| SPECIAL INSTRUCTIONS: FILTERED IN FIELD  | •  |  |   |   |  |                     |
| RSENIC ND(0.001) MG/L BTF  | BTF 13:  |  |   |   |  |                     |
| RSENIC ND(0.001) MG/L BTF ADMIUM 0.0010 MG/L BTF   | BTF 13:<br>BTF - 13:   | BTF = 134 ≠ 57   | 011 EA  | 0.0055  | MG/L   | BTF 131 / 58        |
| ND(0.001) MG/L BTF   | BTF 13:<br>BTF 13:<br>BTF 13:  | BTF = 134 ≠ 57   | INC   | A A 7   | MA II  |                     |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

# TABLE F- | | CHEMICAL ANALYSES

Observation Well: 0WC - 12

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received: 2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-26-81

Time Sampled: 11:45

#### STANDARD CHEMICAL WATER ANALYSIS -

DATE: 03/12/81 -

| _0.12.11.22            | CATIONS                   | <u></u> c 1 |           |                  |           | LABORATORY<br>ANALYSIS |             |
|------------------------|---------------------------|-------------|-----------|------------------|-----------|------------------------|-------------|
| 5 2 <del>1</del> 55 51 | CALCIUM                   | CA+2        | MG/L      | e ea wear        | _         | 88.00                  |             |
|                        | -IRON -                   | FE+2        | MG/L      |                  |           | 0.12                   |             |
|                        | MAGNESIUM                 | MG+2        | MG/L      |                  |           | 17.70                  |             |
| 7//0/2004 50           | MANGANESE                 | MN+2        | MG/L      | 7. T-3.          | 750 STA E | 0.10                   |             |
|                        | POTASSIUM                 | K +1        | MG/L      |                  |           | 2.40                   |             |
| 383 (591)              | SODIUM                    | NA+1        | MG/L -    | 10 T 10 AND 10 C |           | 36+00                  |             |
|                        | ANIONS                    |             |           | <del> </del>     |           |                        |             |
|                        | BICARBONATE               | HC03-1      | MG/L      |                  |           | 322.24                 |             |
| ar 44 +                | CARBONATE                 |             | MG/L      | W 90-            | 4         | 0.46                   |             |
|                        | CHLORIDE                  | CL -1       | MG/L      |                  |           | 20.00                  |             |
|                        | FLUORIDE                  | -F1-        | _MG/L     |                  |           | 0.34                   |             |
|                        | HYDROXIDE                 | OH -1       | MG/L      |                  |           | 0.00                   |             |
|                        | - NITRATE :               | NO3 -1      |           |                  |           | 1.33                   |             |
|                        | PHOSPHATE                 | F:04 -3     | MG/L      |                  |           | 0.15                   |             |
|                        | SULFATE                   | S04 -2      | MG/L      |                  | - 631     | 125.00                 |             |
|                        | SILICATE                  | SI04-4      |           |                  |           | 0.09                   |             |
|                        | SILICA                    |             |           | SI <b>02</b>     | MG/L      | 25.68                  |             |
|                        | TOTAL FREE CAR            | BON DIOXI   | DE _ m    | 002              | MG/L -    | 69.26                  | F115 '8     |
|                        | EQUILIBRIUM CA            | RBON DIOX   | IDE       | 002              | MG/L      | 48.79                  |             |
| Mar. (4. 4. )          | - TOTAL DISSOLVE          | D SOLIDS    | (CALC)    |                  | MG/L -    | 634+33                 |             |
|                        | TOTAL ALKALINI            | TY          | AS        |                  | MG/L      | 264.84                 |             |
|                        | CALCIUM ALKALI            | NITY        | AS        | CAC03            |           |                        |             |
|                        | MAGNESIUM ALKA            |             | AS        |                  | MG/L      | 44.84                  |             |
|                        | SODIUM ALKALIN            |             |           | CACO3            | MG/L      |                        |             |
|                        | TOTAL HARDNESS            |             | AS        |                  | MG/L      | 292.36                 |             |
|                        | CALCIUM HARDNE            |             | AS        |                  | MG/L      |                        | 20 0.0 0.00 |
|                        | MAGNESIUM HARD            |             | AS        |                  | MG/L      | 72.75                  |             |
|                        | NON-CARDONATE             |             |           | -CAC03           |           |                        |             |
|                        | CALCIUM NON-CA            |             |           |                  | MG/L      | 0.00                   |             |
|                        | MACRESIUM NON-            | CARBONATE   |           |                  | MC/L      | 27.90                  |             |
|                        | PH FOUR ARREST            | (EUC)       | F1-       |                  |           | 7.20<br>7.20 m         |             |
|                        | EQUILIBRIUM PH            |             | E.F.      |                  |           | 7.20 11                | 5 5 - F     |
|                        | STABILITY INDE            |             | F1-       |                  |           | 7.21                   |             |
| (77= 176 N/35%         | SATURATION IND            | DECR        |           | RENHEIT          |           | 68.00                  |             |
|                        | TEMPERATURE CONDUCTIVITY, |             |           | MHOS/CM          |           | 859 <sub>+</sub> 00    |             |
| * 14+                  | IONIC STRENGTH            |             | FILLETOL  | mmus/ cm         |           | 0.0122                 |             |
|                        |                           |             | av couce  | TDAT : 0         |           | -6.42                  |             |
|                        | ION BALANCE ERROF         | (PERCENT)   | DY CUNCEN | TERATION         |           | -0.42                  |             |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45 $\mu$  membrane) and acid preserved in the field.

Observation Well: OWC - 13

Ortho Chevron Chemical Company Plant Analyzed by Wilson Laboratories

Salina, Kansas File No. 81-9521

Date Received:

2-27-81

Sampled by:

Woodward-Clyde Consultants

PS, PB, CH

Date Sampled: 2-25-81

Time Sampled: 13:00

|      |  |         |                                 |                      |         | ANAL V       | T BOOK       | /DAGE            |
|------|--|---------|---------------------------------|----------------------|---------|--------------|--------------|------------------|
| r    | ANALYSIS                                   | 501     | CENTRATION                      | UNITS                |         | ANALTE       | - BUUK.      |                  |
|      | LAB NUMBER: 8102-0784A                     |         | DESCRIPTION<br>INSTRUCTION      |                      |         | iπ( ) (E) •• | 9            |                  |
|      | DATE SAMPLED<br>TIME SAMPLED               |         | 2/25/81<br>1300                 |                      |         |              |              | /                |
|      | ALKALINITY, TOTAL CALCIUM, BY EDTA TITRAT: | TON     | 111                             | MG/L, AS CA          |         | CJA          | 07           | / 32             |
|      | CHLORIDE                                   | LUN     | 232                             | MG/L                 |         | BLD-         |              |                  |
|      | FLUORIDE                                   |         |                                 | MG/L                 |         | CUA          |              | / 74             |
| )    | IRON, TOTAL                                |         |                                 | MG/L<br>MG/L         |         | /            | ı.           |                  |
|      | MAGNESIUM                                  |         |                                 | -MG/L 🚟 -            | 31 -    |              |              |                  |
|      | MANGANESE                                  |         | NECO 11                         | MG/L                 |         | - EJA        | .100         | /_ 32            |
|      | NITRATE<br>ORTHOPHOSPHATE                  |         | NB(0.1)<br>NB(0.05)             | MG/L AS P            | ,       | DI D         | 120          | / 0              |
|      | PH   |         | 6.35                            | 1107 E 110 1         |         | LKN          | - 83         | /-78             |
| 1    | POTASSIUM                                  |         |                                 | MG/L                 |         |              | •            |                  |
|      | SILICON<br>SODIUM                          |         | [6]mr                           | -MG/L = ==           | 3 8 8   | -            | ,            |                  |
| £    | SPECIFIC CONDUCTANCE                       |         | 1560                            | UMHOS/CM             |         | MJB-         | 124          | -/-11-           |
| 8    | SULFATE                                    |         |                                 | MG/L                 |         |              | •            |                  |
|      | TOTAL ORGANIC CARBON CONCLUSIONLAB NUMBE   |         |                                 | MG/L                 |         | - GMD-       | <b>6</b> 5 · | / 69             |
|      | CUNCEUSIONLAB NUMBE                        | . BIUZ  |                                 |                      | 8       |              |              |                  |
|      |  |         |                                 |                      |         |              |              |                  |
|      | LAB NUMBER: 8102-0784B                     | SAMPLE  | DESCRIPTION                     | !! ∩⊌C=13            |         |              | -            |                  |
|      | CHE MONBERT BIOZ 0704E                     |         | L INSTRUCTION                   |                      | GLASS F | IBER -       | 188 **       | -                |
| •    |  |         |                                 |                      |         |              |              |                  |
|      | ALDRIN                                     | -       | 16-3<br>ND(1-0)                 |                      | -       | CJE          | 132          |                  |
|      | CHLORDANE<br>4,4-DDD                       |         | A 7A                            | UC /I                |         | - CJB        |              |                  |
|      | 4,4-DDE                                    |         | 0.35                            | - UG∕L :∈<br>UG/L    |         | CIB          | 137          | / 21             |
| 5.00 | 4,4-DDT                                    |         | ND(0.30)                        | UG/L                 |         | - CJB        | 132          | /-21             |
|      | DIELDRIN                                   |         | 1.06                            | UG/L<br>UG/L<br>UG/L |         | CJB<br>BKS-  | 132          |                  |
|      | ENDRIN<br>HEPTACHLOR                       |         | ND(0.40)<br>ND(0.10)<br>ND(2.0) | HG/L ·               |         |              | 132          |                  |
|      | MALATHION                                  |         | ND(2.0)                         | UG/L                 |         | CJE          | 132          | . / . 23         |
|      | SEVIN                                      |         | NOT ANAL.                       | UG/L                 |         |              | 132          |                  |
|      | 2,4,5-T                                    |         | 0.8<br>ND(10.0)<br>ND(10.0)     | UG/L                 |         | CUR          |              | 2 / 22           |
|      | TOXAPHENE<br>PCR                           |         | ND(10.0)                        | 1167F                | 12      | CJI          |              |                  |
|      | LINDANE                                    |         | 2300                            | UG/L                 |         | CJR          |              | 2 / 21           |
|      | METHOXYCHLOR                               |         | ND(0.8)                         | UG/L                 |         | CJB          |              | 2 1.21           |
|      | 2 • 4 - D                                  |         | 1.3                             | UG/L                 |         | CJB          |              | 2 / 21           |
|      | MIREX<br>CAPTAN                            |         | NE(0.5)                         |                      |         | -C3B         | 132          | 2 / 21           |
|      | DIFOLATAN                                  |         | - ND(20)                        | UG/L<br>UG/L         |         | C.IB         |              |                  |
|      | CHLOROBENZILATE                            |         | ND(0.30)                        |                      |         |              | 132          |                  |
|      | GUTHION                                    |         | NT((100)                        | UG/L                 |         | CJB          | 132          | / 23             |
|      | DIAZINON                                   |         | ND(100)<br>ND(0.5)-             | UG/L                 | Eq.     | CJB          | 1-32         | -423-            |
|      | PARATHION, METHYL                          |         | ND(2.0)                         | UG/L                 |         | CJB          | 132          | / 23             |
|      | PARATHION, ETHYL                           |         | NI(0.5)                         | UG/L                 |         | CJE          |              | / 23             |
|      | TRITHION PHOSDRIN (MEVINPHOS)              |         | NOT ANAL.                       | UG/L<br>UG/L         |         | EUB:         | - 132        | 2 / 21<br>2 / 23 |
|      | CONCLUSIONLAR NUMBE                        | R: 8102 | -07B4B                          | J0/ L                |         | 200          |              |                  |
|      |  |         | 10.00                           |                      |         |              |              |                  |
| ı    |  |         |                                 |                      |         |              | -            |                  |
| !!   | LAB NUMBER: 8102-0784C                     |         | DESCRIPTION<br>L INSTRUCTIO     |                      | D IN FI | ELD          | . 80%        |                  |
|      | ARSENIC                                    |         | ND(0.001)                       | MG/L                 | . 10    | RTE          | 1,7,1        | -/-54.           |
|      | CADMIUM                                    |         | 0.0006                          | MG/L                 |         | BTF          |              | / 57             |
|      | COPPER                                     |         | 0.0032                          | MG/L                 |         | BTF          | 131          | √ 56             |
|      | ZINC                                       | D. 0100 | 0.05                            | MG/L                 |         | BTF          |              | / 53             |
| T.   | CONCLUSIONLAB NUMBE                        |         |                                 |                      |         |              |              |                  |
|      |  |         |                                 |                      | -       |              |              |                  |

<sup>\*</sup> Groundwater samples for metals analysis were filtered (0.45, membrane) and acid preserved in the field.

26 March 1981 Dr. J. D. Campbell Page 3

### Organophosphorous Pesticides

The samples were prepared utilizing the same procedure described for the organochlorine pesticides. Since the highly selective flame photometric detector was used for the analyses of these compounds no confirmatory work has been performed.

It was anticipated that Sevin could be analyzed with the organophosphorous pesticides on the nitrogen/phosphorous gas chromatograph detector. However, analyses of the samples indicated that interferences were present, which precluded use of the nitrogen/phosphorous detector for the organophosphorous compounds. The samples were then analyzed with the highly selective flame photometric detector operated in the phosphorous mode. Using this mode of operation, six phosphorous containing compounds were analyzed but Sevin could not be detected because the detector is not sensitive to nitrogen containing compounds.

A standard has been ordered for Trithion but has not been received. The extracts can be re-analyzed for Trithion upon receipt of the standard, however, no unidentified peaks were observed in the analyses of the organophosphorous pesticides indicating that Trithion was not present.

WILSON LABORATORIES

Clifford J. Baker

Chemist

jh

CONFIDENTIAL

